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ABSTRACT

The prevention of injuries and control of hazards in aquatic activities is outlined. Discussions include the causes and prevention of aquatic accidents, aquatic safety in the basic instructional program, the design of public swimming facilities, and safety considerations in pool operation and administration. A chapter is devoted to each of the following aquatic activities: springboard diving, tower diving, water polo, small craft use, water skiing, skin and scuba diving, and surfboarding. (MM)

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Safety in Aquatic Activities

Monograph #5
Sports Safety Series

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Foreword

This fifth in the series of six monographs which comprise the *Sports Safety Series* deals with safety in aquatic activities. It was not possible to include all of the activities which are frequently included under the broad classification of aquatics because of the limitations on the length of this monograph. Consequently, some activities such as whitewater canoeing, rowing and others have not been included. By the same token, most of the discussions are limited to the major considerations for safety. The reference lists at the end of each chapter should provide the individual who is interested in more detailed information with adequate resources.

The responsibility for this revision of the textbook, *Sport Safety*, originally published in 1970 by the Safety Education Division of the American Association for Health, Physical Education and Recreation (AAHPER) has been undertaken by the American School and Community Safety Association (ASCSA) which replaced the Safety Education Division under the revised structure of the AAHPER, The American Alliance for Health, Physical Education and Recreation.

The format of this *Sports Safety Series* was chosen so that it would not be necessary for an individual with interests in specific activity areas to purchase a large publication dealing with all areas of sports and safety. However, in order to accomodate persons who wish to buy all six monographs, a limited number of all six booklets bound into a single volume are available at a reduction in price.

The *Sports Safety Series* includes the following six monographs, all edited by the same committee.

#1 *Administration and Supervision for Safety in Sports*
#2 *Accident Surveillance Systems for Sports*
#3 *Safety in Team Sports*
#4 *Safety in Individual and Dual Sports*
#5 *Safety in Aquatic Activities*
#6 *Safety in Outdoor Recreational Activities.*

The ASCSA and the Co-editors appreciate very much the efforts of the several individual authors who are identified in the list of contributors in each monograph. In many instances the original authors updated or completely revised their original contributions and in other cases alternate authors have presented a somewhat different approach to safety in a specific activity.

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Chapter 1

CAUSES AND PREVENTION OF AQUATIC ACCIDENTS

E. Louise Priest
American National Red Cross

Safety in aquatic activities is dependent upon several factors, and most important among them are the individual's ability to swim, and ability to recognize hazardous conditions and practices. Drowning, and in fact all water accidents, could be prevented if all persons engaging in aquatic activities were capable of doing three things: (a.) swim well enough to remove themselves from dangerous situations, (b.) recognize and avoid hazards and unsafe practices, and (c.) have the knowledge and skill to safely assist others in an emergency. (1) It is the goal of water safety education to provide aquatic enthusiasts with these abilities. Unfortunately, all aquatic enthusiasts do not avail themselves of water safety education. Participation in all forms of aquatic activity continues to rise, and every year nearly 150 million Americans engage in some kind of aquatic recreation. (2) Literally, millions of these people cannot even swim, and in fact as National Safety Council statistics show, 60 percent of drowning fatalities occur to people who *accidentally* find themselves in the water. (6) Thus, the task of public education is a monumental one. Of prime importance to that task is the necessity for educators and professional recreators, including those who are not themselves aquatic enthusiasts, to recognize the causes of aquatic accidents, and to become aware of prevention.

The field of aquatics is amazingly broad, and encompasses swimming, diving, skin and scuba diving, fishing, surfing, water skiing, and boating. The varieties of these activities, and the settings in which they occur are numerous. The accidents which happen to people engaged in these activities, however, invariably are due to one or more of the following factors: (a) inability to swim or to recognize hazards, (b) the condition of the facilities, (c) the condition of, or lack of safety equipment, (d) inadequate or lack of supervisory personnel, and (e) unsafe attitudes and practices. These will be dealt with separately, with specific mention of factors unique to various settings where appropriate.

Swimming Ability

According to the National Safety Council, more than 8,000 persons drowned in the United States in 1975. Of these, about 3,000 were swimming or playing in the water. The remaining 5,000 drownings were non-swimming fatalities, where people fell into the water unintentionally. These included falls from shore, docks, bridges, commercial transport vessels, fishing and recreational boats, and accidents on home premises. Of the total drowning accidents in 1975, 860 involved children under 5 years of age; 1,580 from ages 5 to 14; 2,610 from ages 15 to 24; 1,820 from ages 25 to 44, and 1,200 from ages 45 to 64. Home drowning accidents accounted for approximately 900 of the deaths in 1975. The specific locations included swimming pools (350), bathtubs (230), wells, cisterns, and cess pools (70), other open bodies

of water (100), and unspecified places. (6) In a study designed partially to show the relative frequency of drowning by cause of accident, Gabrielsen (5) cited the following causes in descending order of frequency:

1. Boating
2. Child unattended
3. Falling into water
4. Swimming in unguarded area
5. Stepping into hole
6. Trying to swim too far
7. Injured or intoxicated
8. Shock from cold water
9. Falling off floating object
10. Playing on ice
11. Heavy surf
12. Falling off water skis
13. Working near water and falling in
14. Ice skating
15. Air giving out in scuba
16. Caught in seaweed

Because the majority of fatal water accidents happen to people who had no intention of going into the water, everyone should learn to swim at least well enough to rescue himself or herself in an emergency. The most effective way to learn swimming and water safety is through courses taught by trained instructors. When Commodore Wilbert E. Longfellow started the Life Saving Service of the American Red Cross in 1914, he concentrated wisely on the organization and training of volunteer lifesaving corps throughout the country to supervise otherwise unguarded beaches. It soon became evident, however, that a trained group of life savers was not the final solution to the problems of drownings, and changes in the approach to the problem were reflected in the slogan coined by the Commodore: "Everyone a swimmer, every swimmer a lifesaver." The slogan reflects the philosophy that the next best way to cope with the accidental drowning situation is to train as many people as possible in lifesaving techniques. The total water safety program thus ranges from the teaching of beginning swimming through the most advanced of swimming and lifesaving skills, and throughout an emphasis is placed on safety consciousness and the awareness of causes of aquatic accidents. The level of swimming skill necessary for safety varies somewhat with the type of aquatic activity and the setting. Obviously, the more skilled an individual is, the safer he or she will be. While often disregarded or considered non-essential, swimming ability is necessary for safety in such aquatic activities as scuba diving, water skiing, and all types of boating. In actual fact, the need to know how to swim is paramount in any and all types of aquatic recreation.

Planning A Safe Facility

One of the first principles of water safety is to choose a safe place for aquatic activity of any kind. Obviously, a reasonably safe area is one in which hazards are removed or minimized, to prevent drownings, accidents, injuries or illness.

Following are some of the things that should be considered when choosing or developing a safe facility:

1. Depths of water should be clearly marked, and shallow areas roped off for non-swimmers.
2. The water should be clear and unpolluted.
3. The bottom should have a gentle slope, with no holes, step-offs, or underwater obstructions.
4. The bottom should be free of debris, and should be firm sand or gravel, or concrete.

5. The swimming area should be free of, or protected from, dangerous marine life.
6. Deck or beach area should be free of glass and debris.
7. Rafts, piers and decks should be of sturdy, non-skid construction, and piers and rafts should have railings.
8. Areas should be free of strong currents or strong wave action which are generally hazardous.
9. The swimming area should be fenced, to avoid unauthorized entry.
10. Buoys should mark boundaries between swimming and boating activity areas, and no boats other than guard boats should ever be allowed into the swimming area.
11. Guard chairs should be situated in such a manner that an unobstructed view of the area to be guarded is possible, and should be 5 to 6 feet above deck level.
12. Water of adequate depth for diving is essential if diving is to be allowed. Preferred depth (AAU) is 12 feet for a 1-meter board, 13 feet for a 3-meter board. There is some indication from the Consumer Product Safety Commission report that even these depths may not be adequate to prevent some neck and back injuries. (3)

Chapter 3, pages 15-19, provides more detailed information on construction and operation of swimming pools. Swimming pool owners must keep their facilities safe and healthful by: (a) reducing hazards, and (b) regulating and controlling the conduct and actions of swimmers by enforcing safety rules and regulations strictly and impartially.

Causes of Injuries other than Drowning

Aside from drowning, the conduct of swimmers can and unfortunately does lead to other injuries, some of them permanently disabling. It has been estimated that there are approximately 500 cases of death or permament paralysis annually, resulting from spinal cord injuries caused by diving and water slide accidents. (4) These may be caused by improper use of the slide or board, inadequate depth of the pool, or improper slope of the bottom. This type of injury happens also when there are underwater obstructions, or where diving is allowed (or done) in shallow water. Other, and more minor, injuries which occur around pools are contusions, abrasions, fractures and sprains. These are usually a result of swimmer behavior, and occur when supervision is inadequate and safety rules are not enforced.

Accidents at unenclosed seashore areas may be caused by some additional factors: (a) unknown currents and unexpected wave activity, (b) being struck by a sailboat or other craft which may be in the same area, (c) being carried out beyond swimming areas while on a flotation device, (d) failure to observe flags and danger signals designed to warn swimmers, and (e) rough play on the beach with balls and other game equipment. Water depth can vary greatly with the tide, and bottom conditions can change drastically at ocean beaches, and swimmers must be aware of these factors. Novices and non-swimmers are more likely to get into trouble at beaches and swimming areas that are unfamiliar to them.

Overcrowding and murky water conditions are considered to be factors in many water accidents in public swimming facilities, while inadequate barriers against unauthorized entry may be a factor in private pool drownings.

Equipment

Unfortunately, one of the greatest areas of neglect in aquatic facilities of all kinds is safety equipment. Safety equipment should include basic rescue equipment such as reaching poles, ring buoys, heaving lines, and rescue tubes. In camps and lakes where there are boating activities, there must be an adequate number of U.S. Coast Guard approved personal flotation devices. (PFD's) An approved PFD is required by law for each individual in boating activities, and these should always be *worn* by non-swimmers. Some additional equipment considerations are:

1. Lifelines should be buoyed and secure.
2. First aid equipment should be available, and someone always on duty who is trained in first aid.
3. Every aquatic facility should have a backboard, and personnel should be trained in its use.
4. Properly equipped lifeboats should be available at lake waterfronts. Every lifeboat should have a crew of two. Proper equipment for a lifeguard boat includes extra oars, a throwing ring buoy, a 25' heaving line, a reaching pole, an anchor, a bailer, and a Coast Guard approved PFD for each person aboard.
5. Adequate communication systems for safety will vary with facilities, but all should have a telephone, with emergency numbers clearly posted. Some facilities, because of size, may require two-way radios, public address systems, bullhorns or flags.
6. Where there are resuscitators or respirators, personnel must be trained in their use.

Needless to say, all safety equipment must be kept in good repair, and periodic retraining of personnel in its use is highly advisable. Many facilities provide binoculars, masks, fins and snorkles, and some even scuba gear for rescuers trained in their use. Adequate facility management requires that all equipment should be regularly checked and properly maintained. Respect for this equipment should be taught to swimmers, and no safety equipment should ever be used for play or experimentation by patrons.

Supervisory Personnel

Lack of adequate supervision is one of the main causes of aquatic accidents. All aquatic facilities must be supervised by an adequate number of persons trained in water safety and lifesaving techniques.

Duties of Supervisors. The duties of an effective aquatic supervisor are varied. The principal responsibilities include:

1. inspection of equipment and the facility
2. maintenance of equipment and the facility
3. elimination of hazards where possible
4. marking of non-removable hazards
5. supervision of swimmers
6. teaching

In addition to the above, aquatic administrators are responsible for staff supervision and staff in-service training.

Rules and Regulations. Rules and regulations must be posted and impartially enforced. While some rules vary with conditions in different facilities, some basic safe conduct rules always apply, and are necessary for the safety of all patrons. If strictly adhered to, these rules should prevent many aquatic injuries and accidents. Lists of such rules are available in poster form from local chapters of the American Red Cross, free of charge. These should be conspicuously posted at every aquatic facility.

Supervision of Swimmers. Quite contrary to public opinion, lifeguarding is a non-glamorous, boring, tedious, *exacting* job. The constant, alert surveillance of swimmers is an absolute necessity, and is the most important task of the aquatic supervisor. Texts on lifeguarding are available, and should be used as reference information for all aquatic supervisors.

Supervision during Instructional Programs. In all instructional programs, there must always be a qualified lifeguard on duty, whose *only* duty is guarding and safety surveillance of swimmers.

In-service Training. In-service training of aquatic personnel should include, besides skill reviews, discussion of any hazards or known trouble areas unique to the facility, accident action plan review, and review instructions in the use of any resuscitation equipment. In-service training is often neglected, even though it is known to be effective in maintaining an alert, competent supervisory staff.

Number of Supervisory Staff. It is impossible to give a standard recommendation as to number of staff required for safety. This will always vary according to the facility and patron load. A "rule of thumb" that has sometimes been applied is one supervisor to every 25 swimmers. In actuality, individual judgments must be made, based upon the facility, the swimmer load, and other factors.

Attitudes and Practices

One of the most important factors in preventing aquatic accidents is developing safety attitudes in all persons engaging in aquatic activity. The fostering of safety consciousness should be of prime consideration in all instructional programs. It is extremely difficult to interest people in safety, and to convince them that accidents do not "just happen," they are *caused*. However, the overall attitude of supervisory staff, the clear posting and enforcing of rules, and a continuing emphasis on the need for safety will do much to foster the safety consciousness so necessary for a safe aquatic facility.

Some of the unsafe situations that result in drownings are as follows:

1. non-swimmers who step off into a hole, or get into deep water and are unable to regain their footing
2. novices or weak swimmers who become exhausted and panic, or who overestimate their ability
3. swimmers who become exhausted, or have a cramp and panic

Some unsafe practices that result in injury or drowning are as follows:

1. diving into shallow water, and diving into unknown water where there are obstructions
2. running on decks, runways and ramps
3. diving from the board before the previous diver has moved away from under the board
4. non-swimmers relying upon flotation devices in deep water
5. getting caught in weeds, currents, and undertows
6. swimming alone
7. swimming in unguarded, unsafe area or facility
8. pushing people into the water
9. going to the aid of someone in trouble, when untrained in proper lifesaving techniques
10. swimming while intoxicated

Accidents and loss of life in aquatic activities are unnecessary, and are too often the result of negligence. Most, if not all such incidents, could be avoided. Even with concerted and informed efforts, we may never eliminate all aquatic accidents. However, if proper emphasis were given to learning to swim, maintaining a safe facility, proper safety equipment, adequate supervisory personnel, and the promotion of safe attitudes and practices, it would go a long way towards minimizing this needless suffering. The task is a big one, and will never be accomplished without a concerted effort on the part of all involved. Safety is everybody's job.

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Chapter 2

AQUATIC SAFETY IN THE BASIC INSTRUCTIONAL PROGRAM

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The importance of safety procedures before, during, and after instructional classes in swimming is emphasized in this chapter. This includes the usual classes in beginning, intermediate, advanced swimming and diving, life saving and water safety and classes in scuba diving.

Aquatic safety has been an important concern ever since Nicholas Winmann wrote the first book on swimming in 1538. From the time Commodore Wilbert E. Longfellow founded the U.S. Volunteer Life Saving Corps in 1890, through the years of the YMCA's Life Saving promotion program in 1909, the American Red Cross in 1914, and the founding of the Council for National Cooperation in Aquatics in 1951, there have been many developments in the area of aquatic safety.

It is important that all instructors know and understand the importance of safety information, and that they teach safety skills, at all levels of instruction.

Aquatic organizations such as the Council for National Cooperation in Aquatics (C.N.C.A.) and the Aquatic Council of the American Alliance for Health, Physical Education and Recreation emphasize the necessity of requiring a lifeguard to be on duty during all beginning swimming classes wherever they are conducted. This concern relates primarily to the legal liability for accidents in all class-oriented aquatic classes.

According to the American Red Cross (A.R.C.): "Safety in and on the water begins with the ability to swim well enough to care for one's self under ordinary conditions." Real water safety is also based upon the following factors:

1. Ability to recognize and avoid hazardous water conditions and practices
2. Ability to use self-rescue skills to get out of dangerous situations
3. Skill in rescuing or assisting persons in danger of drowning (1)

Aquatic safety begins with well-trained, experienced aquatic workers at all levels from volunteers to professionals and administrators. This knowledge base is of extreme importance not only to reduce accidents but also for protection against liability suits for today more people are willing to take legal action in cases of injury or death due to accidents. The latter has compelled leading aquatic organizations to advocate certification programs for aquatic workers at all levels and to set up minimum standards in all aquatic areas.

Aquatic Accidents

The number of "water accidents" and drownings are increasing each year at an alarming rate in proportion to the increasing number of participants.

Gabrielsen, Spears and Gabrielsen (5) recommend various ways to eliminate these unfortu-

nate incidents and outline steps that should be followed. According to Gabrielsen *et al.* (5), responsibility rests with parents, public education, and the community. These groups have the full cooperation of the state and the nation with new legislation and safety rules for all aquatic activities.

Although this discussion centers around a "controlled" or class situation, many other important safety procedures must be followed regarding pool, beach or dock facilities, water sanitation and basic rules and regulations concerning safety equipment and lifeguard training.

In addition to the prevention of drownings, water safety is concerned with the total health and welfare of people in all aquatic activities. It deals with the causes, prevention and elimination of conditions, practices, or procedures which may be detrimental to any participant.

Knowledge necessary for safety in aquatics consists in a large measure of knowing when, where, and how much to participate. Safety skills include primarily the abilities to meet common hazardous conditions with which the swimmer may be confronted. This is the substance of personal safety in the water. This knowledge and skill should be included as an important part of all levels of instruction in aquatic activities.

A water safety program has as its primary objective the creation in every individual of an awareness of accident causes and the ways in which accidents can be prevented. Experience has shown that the most effective way to attain this objective is through certified courses taught by trained instructors.

Aquatic Administration

The responsibilities for keeping aquatic facilities safe and healthful lies with the owner of the facility and the Director of Aquatics. Standards are now being formulated for aquatic workers at all levels. Soon all aquatic workers will have to be certified in their particular area before they can secure positions. It is the primary responsibility of the aquatic administrator to:

1. Reduce hazards to a minimum.
2. Control and regulate the actions and conduct of patrons who may cause injuries to themselves or to others. Some things may be done safely in the water or on land, while others may not; these should be stated as rules and regulations and be posted in prominent places.
3. Protect the safety, health and welfare of patrons by enforcing the rules and regulations which have been established for the good of all.

Adequate supervision of the facility must be maintained at all times. Lack of proper and continuous supervision is one of the major causes of accidents and fatalities. Supervision is a state of mind. One must be alert to anticipate and observe potentially dangerous situations and to prevent their occurrence.

Water safety begins with learning to swim and receiving instruction in aquatic skills and knowledge which will enable an individual to take care of himself in the water in emergency situations.

The Teaching Area

The Council for National Cooperation in Aquatics (3) has excellent recommendations for minimum standards for swimming pools. It is important that these standards be followed in the planning of all new pools. Many of these recommendations may be carried over to beach, lake or dock situations.

Water depth will depend upon the instructor's methods and ideas about whether it is best that a beginner be taught in shallow water where the pupil may stand on the pool bottom or in the deep water using a flotation device in order that the pupil may not use the pool bottom as a "crutch."

In the case of pools, the deck markings should avoid the word "Deep" as in "5 feet deep" to deter a swimmer who sees only the word "Deep" from diving head first into a pool area designed for swimming rather than diving.

With regard to natural swimming areas, some basic requirements in developing a safe waterfront include pure, unpolluted, and tested water; a firm bottom with proper slope, free of slip-offs, holes, broken bottles, and cans; proper depths for teaching nonswimmers and for lifesaving and diving skills; special considerations should be given to tide, currents, undertows, and other water movement. Consideration should also be given to waves which are dangerous to nonswimmers as well as to dock structures and to harmful varieties of marine life (for example jellyfish, Portuguese man-of-war, and stingray) located in or adjacent to the swimming facility.

If a bathing place is to be made reasonably safe, provisions must be made for the prevention of drownings, accidents, illnesses, and injuries. Proper supervision and suitable equipment are required for the detection and rescue of those who get into difficulty. A safe facility is just as necessary for nonswimmers as it is for advanced swimmers.

Personal Safety

According to Moloney (8) safe swimming is no accident. It begins with identifying a place that people "seek out" to enjoy aquatic activities. In most cases, these areas may be "set up" as good teaching areas.

Moloney recommends that water safety conscious instructors look at certain factors when visiting a swimming pool for the first time.

The recommendations include:

1. Non-slip decks
2. Water depths in diving areas (appropriately marked)
3. Proper deck markings
4. Lighting
5. Water sanitation
6. Overflow system design
7. Play equipment
8. Posted rules and regulations
9. Posted "Emergency Procedures"
10. Provisions for securing the pool when not in use

It is important that rules and regulations concerning health and safety be thoroughly explained not only to the pupils in the class, but to their parents as well. Parents should inform the instructors of any type of illness that their child may be susceptible to including skin rashes, ear troubles, seizures, etc.

In aquatic areas other than pools, the YMCA has listed potential safeguards which are as follows:

1. The bottom of the swimming area is free of hidden hazards and the slope of the beach is gradual.
2. The surrounding beach is a controlled area.
3. Water sanitation is adequate.
4. Safety equipment such as poles, ropes, floating devices are at hand.
5. First-aid kit is available.
6. Emergency procedures are written out.
7. All dock and pier areas are free of hazards.

The Aquatic Instructor

All teachers in aquatic classes should be well trained and have been taught in a certified program. They should be aware of existing state and national laws concerning teaching in public or private schools, agencies and clubs.

A certified, efficient and effective aquatic instructor must be knowledgable concerning all of his specific responsibilities. They include inspection and maintenance of the facility and equipment, elimination of typical removable hazards in and around the facility, marking those which cannot be removed to make them conspicuous, keeping other staff members alerted to their duties, and teaching survival techniques and knowledge as well as swimming skills.

He must see that rules and regulations for health and safety are conspicuously posted, are understood by all participants, and then he must see that these rules are enforced. In supervised and well-regulated facilities, custom and knowledge of local conditions will often dictate those regulations needed to govern the conduct of bathers.

Basic safety considerations to protect swimmers should include slow and gradual adjustment to water, restricted areas for swimming, diving, boating, canoeing, and sailing, regularly scheduled periods for aquatic activities; constant, alert, and competent supervision of the aquatic facility or waterfront; ability tests to be sure that swimmers are properly classified, checking systems both into and out of the water, availability of rescue equipment recommended by the A.R.C. These include lifelines, booms, ring buoys, Shepherd's Crook, heaving line, safety post, lifeguard stands, backboards, allaboards, rescue tubes, folding canvas stretcher, rescue boards, lifeboats, whistles and snorkeling equipment (2).

Safety Procedures for Class Instruction

The safety procedures followed in all basic classes for beginning, intermediate, advanced swimming and diving classes should be similar. Safety for basic classes in skin and scuba diving are more involved, therefore, merit a separate chapter in this monograph.

Rules and regulations concerning safety procedures in aquatic classes vary from state to state. Some states have no rules to cover a class situation. National and state aquatic associations are concerned with establishing uniform laws that cover certification of teachers, lifeguards, minimum standards, etc.

In the State of Pennsylvania, for instance, it is the law that "any person holding a valid certificate to teach in the public schools of the Commonwealth may teach scheduled instruction of classes in swimming provided that such a person holds valid current certification as an ARC Water Safety Instructor or YMCA Aquatic Instructor or Director."

It is also a law that "when a school's pool is open for student recreational use, a person holding a lifeguard certification shall be in attendance at all times."

The question of requiring a lifeguard on duty during all beginning swimming classes is becoming more and more prominent in discussions at state and national conferences.

Accident Prevention in Swimming Instruction

How can integration of the prevention of accidents and the control of injuries be accomplished in the teaching of elementary swimming? Age of the pupils in a class must be considered. It seems to be the custom to associate nonswimmers with children, whereas there are adults who are also nonswimmers. The age of the pupils in the nonswimmer group is the clue to the method of approach, the order in which skills will be presented, and whether or not the appeal should be made to a younger mind or a mature mind. The National Safety Council states that to teach beginner swimming to a six-year-old is quite different from teaching it to a 12-year-old, a 16-year-old, or an adult. The skills are the same for all, but the teaching method

and the order of presenting the skills are different. Teaching techniques must be adapted to the physical and mental abilities of the student.

It is important that the students in the aquatics classes, starting with beginning swimming, be taught water survival techniques and skills related to safety in and around water.

Water survival training should be as much a part of the elementary school curriculum as driver education is for the high school curriculum. To teach a youngster to swim without an appreciation for some of the basic safety factors related to an aquatic environment is comparable to teaching a person to drive without respect for the rules of the road.

Teaching Guidelines

The American Red Cross (1) recommends several general methods of presenting water safety information and skills to a class in beginning swimming. Among the suggestions are to:

1. Work in a safe and healthful area. The children become accustomed to the high standards of a safe area and will recognize an area that does not employ the commonly accepted criteria of safety.
2. Discuss and demonstrate accident prevention skills. (Drownproofing)
3. Use visual aids, such as pictures, posters, texts, newspapers, and films.
4. Let the pupils practice under supervision and with correction.
5. Include safety instruction in the rules and regulations of the facility. (The instructor can present to the class the good and bad features of the facility. In this way hopefully the pupils will learn to distinguish between the good and bad features of a waterfront. It will help them learn to recognize safe water conditions.)
6. Call to the attention of the class any bathers who behave improperly in the water.
7. Whenever the occasion arises, point out to the class the safe limits of their area. Remind them that this information is posted.
8. Caution the class about any inherent dangers that may be involved in presenting a given skill.
9. Permit the use of flotation devices to overcome certain coordination problems. (Those who bring flotation devices to the area, however, should remain within the nonswimmer area when using them.)
10. Give ability tests to newcomers.
11. Remember that the ultimate objective is, "to create in every individual an awareness of the causes of accidents, how they can be prevented and a desire to be safe.
12. Everyone needs to know certain things about being safe in the water. That is the meaning of the statement that one cannot take land habits into the water and be safe; he has to learn the "rules of the water."

Although these suggestions may seem to be directed particularly to the beginning swimmer, they are just as applicable to the intermediate and advanced swimmers. Often as individuals become more familiar with the water environment they become less aware of potential dangers. All swimmers need a periodic reminder that safety comes first in aquatic activities.

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Chapter 3

THE DESIGN OF PUBLIC SWIMMING FACILITIES

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This chapter is an attempt to provide basic design and operational standards for public swimming facilities. It should be understood as a checklist which is useful for the student, aquatic area managers, and the lay building committee. For our purposes, the terms indoor pool, outdoor pool, and beach will refer to swimming places that are operated by all types of organized groups. Private residential pools will not be discussed.

The Beach

There should be specific set lifeguard positions on a beach. Start with a wooden center tower, 15-20 feet high, which will seat 2-3 lifeguards and store emergency equipment. This tower and other chairs which will be described, should be placed close to the edge of the water, depending on the tide pattern. On either side of the center tower there should be single seat 7 feet high lifeguard chairs, spaced not more than 50 yards apart. This gives optimum coverage of swimmers and facilitates communication between guards. Figure 1 shows a ¼-mile section of lifeguard stations. Towers are placed at both ends and the center of the beach.

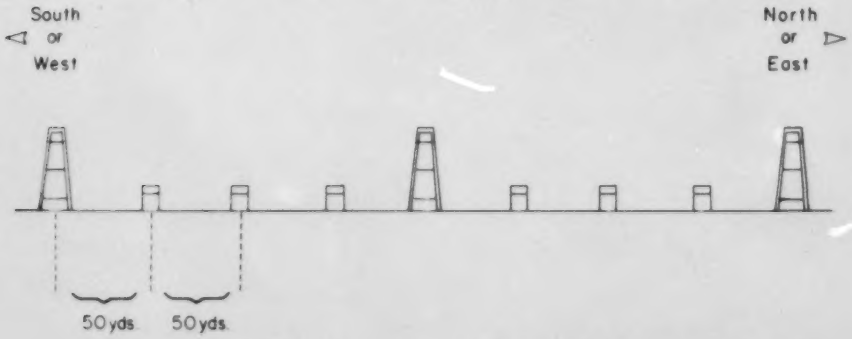

Figure 1: Arrangement for Lifeguard Towers and Chairs at a Swimming Beach

Such a design defines clearly the guarded sector and enables the guards to be seen as well as heard as they oversee the area. Such an alignment permits the development of a systematic rotation of individual guards, and expedites coverage of all areas during emergency situations. The guards can build up sand piles in front of the towers in order to break their jump and prevent injury as they exit the towers. Signs should be posted on chairs and towers prohibiting beach patrons from occupying areas between the lifeguard stations and the water's edge.

Buoys well-anchored in the water should define the limits of the swimming area. The distance and depth these buoys should be placed from shore will be determined by the tide and the space needed to accomodate the number of people expected at peak hours. Buoys should not be used to mark off the deep areas from the shallow ones because inexperienced swimmers may be attracted to these demarcation cans and thus put themselves in a position of danger. Fifty feet beyond this initial line of markers which is referred to as "the swimmer limit line," there should be a second line of buoys with lights that is the "the boat limit line." General navigational procedures do not permit boats to pass between these markers. Swimmers in the water are thus assured protection from motor boats and other craft.

Safety equipment at a beach will vary according to particular needs. Minimal equipment includes binoculars at each tower, first aid kits, 3 sets of fins, snorkels and masks, rescue tubes at each lifeguard station, surfboards at each tower, 2 rowboats for each ¼-mile section of beach, communication equipment and basic maintenance equipment. One might employ a system of colored flags to tell patrons if particular sectors of the beach are open and to inform them of conditions of the current and undertow. For the development of an effective communication system, whistles, emergency air horns, two-way radios, and telephones are all useful tools. A basic system of hand signals should be operative. A communication network which includes a nurse's office, state, local and park police, and all of the guards is the only way large numbers of people can be guarded safely. As an important adjunct to a system of chairs and towers, standing positions along the shoreline and/or in the water and boat and surfboard stations in the water are excellent ways of patrolling heavily used areas. For a minimum design of a beach area see Figure 2.

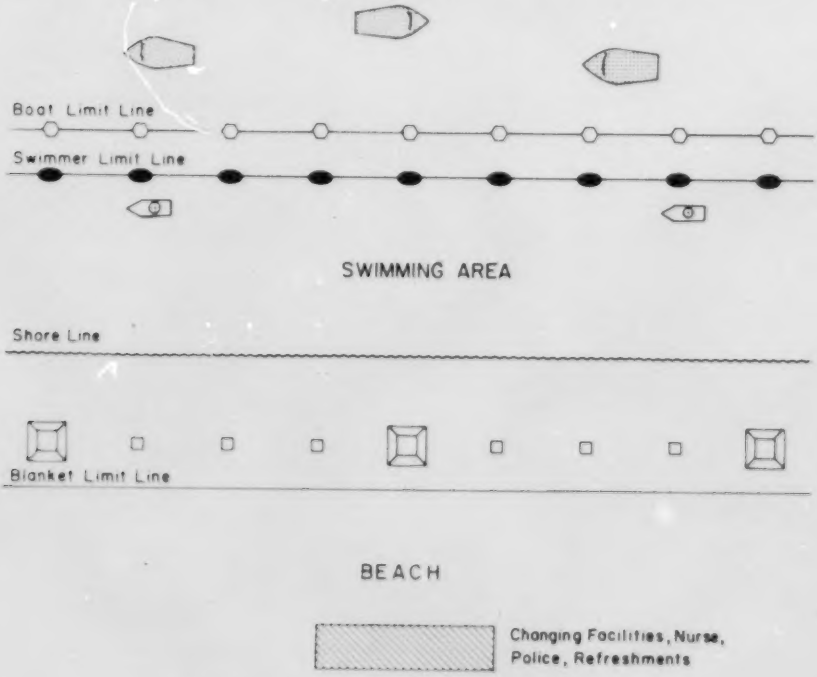

Figure 2: Layout of Beach Area for Minimum Safety of Patrons

Indoor Pool

Proper design of an indoor pool facility is a difficult task. Unlike the beach area where nature has set forth conditions and the limitations, man designs the indoor pool environment, usually with one eye on capacity and another on finances. Economy of operating costs should be a real consideration in plant design and material selection. Too often this is not true.

Every pool should be built to serve the young and old of both sexes, and the physically handicapped. The activities spectrum should include recreational swimming and instruction for all ages, and organized competition and games. It is an absolute folly to design indoor pool complexes with only one segment of the population, or one type of program in mind. The traditional 25-yard, 3' 6" deep to 12' deep rectangular pool design does not serve the real needs of the people and programs it is built for. But before we discuss the pool proper, let us discuss the overall complex in general.

The pool area should be designed as the focal point in the overall plant. Adjacent areas, whether they pre-exist or not, such as basketball and tennis courts, running tracks, gymnastic rooms, should all be considered when initial design considerations are made. We will not discuss the factors of design in these auxilliary areas in this chapter since the space provided will only accomodate a review of these areas that are necessary to the operation of the pool.

For security reasons, it is of the utmost necessity to section off areas of the complex according to the programs and activities that will be carried on. Based on this principle, one naturally starts with the entrance of the building. If the building is designed with operating costs in mind, only one centrally located ticket-taker will be needed. This saves money and insures proper inspection and payment, if fees are to be charged and/or attendance kept. Such an area should work as an information center, with public pay phones, secondary rest rooms, and a waiting area with seats and bulletin boards and pick-up area. A suitable entrance must also provide for the handicapped.

Depending on the number of people one expects at peak time in the locker room, 15 square feet per person should be provided for dressing areas. Additional space should be added for toilets and showers, however excess space should not be allotted since horseplay is the result. If possible but not necessarily, a one-way window that looks into the locker room from a staff office should be installed for supervision purposes. Vandal proof everything that can be destroyed, especially fixtures such as clocks and thermostats. Install special keyed on-off light switches. These switches will enable management to control electrical costs and protect patrons from being suddenly thrust into darkness in the locker area. In addition, the locker rooms will have to be checked by coaches, teachers, lifeguards and/or supervisors; a special locker room attendant is generally an unnecessary expense.

Be sparing with glass. Glass breaks easily and particles may end up on the floor creating unnecessary injury. Architects today have attractive designs and materials that are almost graffitti-proof. Investigate those possibilities especially for use in elevators and toilet areas. Hair dryers are beneficial but can cause maintenance problems. Towel bills will soar during school hours unless proper supervision can be provided. A secure towel room and pick up system for used towels is a primary design element. Otherwise, even dirty towels will disappear. Do not build an equipment room in the locker room area. Coaches will send a student for a ball or other piece of equipment and it is often tempting to steal valuables from the locker room while looking for equipment. Children might also tend to play with the equipment in this potentially dangerous area. Women's cubicles should be 3 feet by 3 feet. The design of the locker room should be strictly utilitarian. The ratio of toilets and urinals to users should be 1 toilet for every 40 women, 1 toilet for every 60 men and 1 urinal for every 60 men. Changing and toilet facilities should be the only function of the locker room. Most locker rooms today can be and are very dangerous. Coated metals, or no metals at all would be safest.

Exits should be planned so one group can exit the locker room while another can enter without conflict.

The shower area should be isolated from the locker room and the pool, serving as the physical link between them, both for sanitary reasons and because locked off and separate, management can control use, thereby reducing vandalism and injury due to horseplay. Everyone on an after-school team can take a shower and then move into the drying-off area at which time the supervisor can lock the shower area.

There should be one shower head for every 40 persons during peak pool time usage. The floor should be non-slip and the lighting vandal proof. Stainless steel fixtures are best: water temperatures, controlled from the coaches' office should be in the range of 90°-100°. A separate drying area is advisable, without doors where excess water can be caught thereby reducing the risk of injury in the locker room area. The towel storage might be located off this area. Regardless of the design of these areas, cleanliness, sanitation and disinfection are primary concerns. Depending on the size and capacity of the locker area strategically placed custodian work rooms are necessary.

Pool Area Proper

The recommended standards set forth in the following section have been sanctioned by the National Swimming Pool Institute, the American Red Cross, the Council for National Co-Operation in Aquatics and/or the NCAA.

Deck. The deck should be a minimum of 6' wide or a maximum of 20' wide. We recommend 12' wide as the most useful width based on the varying program demands such as the number of swimmers on the deck at once, an example being the number of swim team members on the deck during a competitive swim meet. Non-slip materials should be used, especially where people exit from the shower areas. Sunlight should not shine on the deck as algae will grow and there should be one floor drain for every 250 square feet of deck. When installing these floor drains, make sure they are the type that are easily maintained. All decking should slope gradually toward the drains. Hose nipple and available water faucets should be located every 50 feet so the entire area may be easily maintained and cleaned.

A separate section at deck level of at least 1200 square feet should be included for spectators with a direct way of entering and exiting that leads from the main entrance, and which avoids crossing any of the pool deck proper. Spectators will be able to come and go as they please, and they will not track dirt, nor possibly slip and injure themselves. The shower exit should be at the shallow end of the pool so nonswimmers do not enter the deep water and unfinished concrete should not be used for the deck surface as it breeds algae and fungus. In the future a specially designed carpet may make the deck much safer. Presently there are no carpets that realistically serve this purpose.

Walls and Ceilings. No large windows should be installed. The glass is easily broken, sometimes shattering into the pool and illegal entry is facilitated. Thoughts should be given to a recessed skylight that will illuminate the area without projecting sunlight on the pool water or deck, but in no way should this skylight be depended on as the only source of light. All wall surfaces and the ceiling should be coated with a moisture resistant paint that will seal the surface and facilitate cleaning operations. Any portion of the walls that jut out thereby becoming a possible hazard to someone who might slip, fall, or lean against them, should be rounded off or padded. Provisions should be made in the beginning for installation in the ceiling of acoustical materials, otherwise the pool as a learning center will be greatly limited.

A double door exit 15 feet wide by 12 feet high at deck level should be considered. Such an entry makes possible the inclusion of boating programs (kayak and canoe handling).

Relative humidity should be maintained at 50 to 60 percent and ventilation should be concentrated on the spectators' area with the area being ventilated 4 times an hour when spectators are present. Do not locate the ventilation ducts at deck level because drafts will make swimmers uncomfortable.

Pool depth and ceiling height are the two most expensive factors of design today. There is no need to build a ceiling any higher than 20' except above the diving stations which are discussed in some detail in Chapter 5.

Temperature. The air temperature in the pool area should be a minimum of 10°F (27°C) without spectators and the water should be a minimum of 80°F (27°C). During competitive meets the room temperature should be 82°F (28°C) and the water should be 76°F (24°C). Cooling off the water does not present a time problem but it does mean new cold water must be introduced into the system. Groups like the senior citizens, the handicapped and small children, need the warmest water and heaters have been developed that will allow for rapid raising of temperature. Temperature recovery rates today are one degree/hour and with the proper scheduling of swim meets during the competitive season, the temperature can be brought up to 80°F (27°C) from 76°F (24°C) overnight or even in a four-hour period if the need be. One can control humidity by removing the moist air and introducing dry air. Infrared lamps at the starting blocks can be an alternative to increasing the temperature of the room during swim meets.

Lighting. Those responsible for pool designs should be extremely wary of recommended lighting levels. Without enough light there is a problem of safe lighting levels for the swimmers and lifeguards and with too much lighting there is a problem of glare. The minimum amount of illumination on the deck should be 50 foot candles. The ideal amount of light on the deck should be 100 foot candles. The water surface must be lighted. The deepest area of the pool and end walls where turns will take place should be illuminated with a minimum of 100 foot candle power. Too intensive lighting right over the diving area or in the divers' eyes should be avoided as it may cause accidents. When lights are located over the water area, a way of replacing the bulbs when the need arises must be considered.

Color of Area. The walls and the bottom of the pool should be white for sanitary reasons as well as safety. The walls of the building should be a subdued color, especially behind the diving area. With regard to all color, a major consideration should be to minimize glare.

Overflow System. Today's designers can recommend a variety of overflow systems. Types include a fully recessed overflow, a partially recessed overflow, the surface skimmer system, the rim flow system and the roll-out design. The skimmer baskets work extremely well as easy collection spots where leaves and pine needles are prevalent. However, they will not prevent pool turbulence. The choice among overflow systems for indoor pools depends on the amount of money available and on the programs and public that will be using the pool. For safe competitive purposes it is necessary to see a clearly defined wall as turns are executed. The roll-out design and rim flow system do not provide for a raised vertical wall. Also, with the roll-out system, the deck is pitched at a 5% slope for the first 10', and a wet deck may precipitate a dangerous accident. The wisest approach is to compare the program needs with the costs, strong and weak points of each overflow system, and then to choose the system that offers the greatest practibility and safety protection. Regardless of the system chosen, be sure, except in the case of the skimmer system, the overflow leads to the surge tank and that a sufficient rate of recirculation is maintained when the pool is being used at peak times.

Pool Bottoms and Underwater Fixtures. Underwater lighting is extremely expensive and an unnecessary extra. If underwater lights are installed, the safety of these lights must be

the primary concern. The light fixtures should be flush with the wall and properly grounded. Three watts/square foot is the minimum wattage desirable.

There are two types of pool bottoms — one is the type that is finished with a protective coating. The other is tile. If protective coating is utilized, do not use a coating material that is slippery, such as gloss enamel paint. Have ladders placed in the side walls not in the end walls. Recess all steps into the wall. Use non-corrosive material for all metal fittings and if possible but it is not necessary, install an underwater window 4 feet by 8 feet in one of the side walls in the deep end for educational purposes.

Today's designs often provide for too much water in the deep end. Deep water is harder to supervise and is necessary only for diving. The diving well must be separate from the remainder of the pool for safety reasons. Moveable bottoms are in the experimental stages of development at present, but might offer a solution for future years. A load limit of one person for every 25 square feet of water is recommended. Adults can swim in water 4' deep; 2-4 year olds need water that is no more than 18 inches deep and 4-8 year olds do not need more than 36 inches of water depth. For competitive swimming there should be a depth of 4 feet. The ideal minimal pool that serves the needs of all ages excluding the diving area should run 18 inches to 5 feet deep. A moveable bulkhead may be installed so a 25-yard competitive course can be laid out with depths between 4 feet and 5 feet. The remaining 25 yards of the swimming area would run from 18 inches to 4 feet deep. It is best to segment the water areas according to the programs that will be using them. Buoy lines should be placed 12 inches before significant depth changes and the slope of the bottom should be gradual. The minimum width of the pool should be 46 feet which will provide six 7-feet lanes and a 2-foot buffer zone at each side wall.

Equipment Storage Room. The equipment storage room should be 200 square feet with hose nipples located on 2 of the 4 walls and a drainage pit. The floor should be waterproof and there should be a double exit door 10' wide by 12' high that leads to the delivery access road. All equipment should be kept off the floor on shelves and racks. One waterproof cabinet should be installed for supplies such as paper towels, etc. Lighting should be a minimum of 75 foot candles.

Filter Room. As in the equipment storage room, the filter room should have a 10' wide by 12' high double exit door that leads to the outside access road. There should be a complete change of air four times an hour along with a minimum of 75 foot candles for lighting. There should be a drainage pit and the floor should be waterproof — probably concrete. A hose nipple should be located on each wall. Ground fault protection of motors, lighting fixtures, and recepticals must be installed. All dry chemicals should be stored on wooden platforms and provisions should be made to insure that the room is fire retardant. The ceiling should be a minimum of 20' high so that equipment can be moved easily and a separate area of the room should have tool racks and shelves. Safety signs should be posted throughout the room and eye goggles should be worn whenever working with the chemicals. Corrosion resistant materials should be standard throughout the filter room especially in or near areas where the chemicals are stored.

The Outdoor Pool

The outdoor pool design requires the safety considerations we have described for the beach and indoor pool. A few additional requirements relate to security, cleaning, and maintenance work, lifeguard stations and food.

A chain link fence at least 6' high should surround the entire pool, with 2 or 3 self-latching gates. The main entrance gate should be at least 6' wide so as to accomodate exiting and entering traffic.

The lifeguard stations should situated in positions best suited for crowd coverage with minimum overlap but no blind spots. Lifeguards should wear sunglasses and post umbrellas in order to minimize glare. All eating, drinking and smoking should be prohibited inside the pool fence for safety reasons.

Power, Water Quality, Sanitation, Security. Power lines should be underground for safety and aesthetic reasons. Lockable power sources should also be placed strategically throughout an area so electricity is readily available for maintenance and special events.

The standards for water quality in swimming areas are set by state and local boards of health. Major factors involved in maintenance of clean, clear water is complex. A limited discussion of pool sanitation is provided in the succeeding chapter. Managers of pools and beaches must be familiar with local health laws. Before assuming the duties involved with a newly installed filtration system, they should participate in a complete orientation and training session. This session should be conducted at the pool that the manager will operate. They should be conducted by the manufacturers of the filter system and the builder of the pool. An excellent book on pool filters and chemicals is the *Swimming Pool Operators Handbook*, published by the National Swimming Pool Institute of Washington, D.C.

Pool chemicals are dangerous. To guess at how much chlorine to put into the water can prove harmful to the public as well as to the person who adds it. Pool managers should learn how to operate and maintain the proper chemical feeders. Proper water testing procedures should be used and tests recorded on a regular basis and presented to the health authorities.

Changing and Sanitation Facilities. In providing sanitation and changing facilities, designers ought to consider the pattern of use by patrons. Boards of health may require by law a standard number of units in the changing and sanitation building. Such standards are usually based on the expected peak capacity load. However, patterns of use may vary. Patrons may go to beaches for 2-8 hours, but to an indoor pool for only 45 minutes. Summer pool users may come a short distance, already dressed in their suits, and will have little use for changing facilities.

Security. Illegal entry and vandalism is common in public facilities. The social and economic costs are great, and in aquatic areas there is danger to the intruder. Unsupervised areas must be securely closed to casual entrance or patrolled in the case of beaches. Patrons have to be able to use one area of an indoor facility while other sections of the building are locked off. Pools which are part of larger complexes, as in schools, must be designed and equipped for physical isolation from other areas. School administrators are rarely willing to permit the general public to wander unsupervised through academic areas. But many modern schools do not lend themselves well to isolating specific facilities.

On the other hand, common areas such as locker rooms should be available in such a plan so that construction and operational costs do not skyrocket. Local fire laws must also be observed so easy egress is available in case of emergency. If one can design areas with security and the avoidance of vandalism in mind, and instructors do not leave equipment exposed during unsupervised times, the safety of the user will be protected and one will be able to keep the costs of operation to a minimum. An important point to consider from the outset of design considerations is what provisions must be made for people who are not using the aquatic portion of the plant or who are in areas legally or illegally that are not constantly supervised. Supervision is an operational cost factor that can be limited by proper design considerations.

Management of Aquatic Areas

Regardless of the design one chooses or inherits, the proper management of the swimming area is the key that will determine the success of the facility. Before opening, certain procedures must be taken so the maintenance and lifesaving system can be properly initiated.

The managing authority must assume or delegate responsibility for operation of the total area to one person. Communities that try to operate their seasonal aquatic center in a 10 to 12 week period with a part-time manager have a most difficult task, as proper set-up time is rarely available. Selecting a pool manager with a successful managerial background (especially dealing with adolescents), who is also up-to-date and proficient in water safety, first aid, and water treatment skills, is important. However, the real key is to find such a person and to allow him or her enough time to seek out the resources needed to set up and stay in tune with the latest water safety techniques. Due to the special nature of the swimming area there will be times when the manager will employ approaches that require techniques appropriate for the moment. The lifeguard staff, parents, children and the facility itself will all put demands on the manager and sometimes these demands will come in the form of an emergency. The ground work the manager has done in the areas of staff hiring, screening, rotation systems, payment, scheduling, facility modification, public information and regulations, and especially in-service training, since lifesaving techniques are changing so rapidly, will all play a part in the final outcome of the emergency situation. Drownings do not occur due simply to the depth of the water. Drownings are caused by a combination of small factors all coming together at a precise moment.

Once the manager is hired, the rules and regulations must be put into effect along with the basic program philosophy of the facility. After basic safety precautions are taken, the satisfaction and enjoyment of the user should be paramount. A suitable set of rules and regulations, used by the New York State Park and Recreation Division is provided.

General Rules and Regulations

1. All persons must obey rules and requests made by the lifesaving personnel.
2. Friends and relatives may not visit lifeguards during duty hours.
3. Distracting lifeguards is prohibited. Diversions of their attention could result in a fatality.
4. Lifeguards may not engage in any unnecessary conversation with anyone, or engage in any other distracting activity other than their protective duties.
5. Safety equipment or furniture must not be altered, moved, or used by unauthorized persons.
6. Glass items, sticks, stones or any object which is not part of the regular programmed equipment items are not allowed in the swimming area. Ball playing on the beach or pool is strictly prohibited.
7. Animals or pets of any kind are not permitted on the beach or pool deck area under any circumstances.
8. Individuals with skin eruptions, open wounds, sores or bandages, or any contagious disease are not permitted on beaches or in the pool area. Urinating, expectorating or blowing the nose in any swimming pool is prohibited.
9. People under influence of alcohol or narcotics are prohibited from using beach or pool facilities.
10. Abusive or foul language is prohibited. Patrons pursuing such course will be immediately expelled.
11. Youth group instructors, lifeguards, or volunteers are subject to the direction of the head lifeguard.
12. No person may teach swimming or conduct aquatic group activity without the approval of the park superintendent, in writing.
13. Swimming is prohibited before opening, after closing, and all other times when a park lifeguard is not officially on duty.
14. Night swimming is allowed only when a provision has been made for such activity by the regional park office.

15. Water circulating and purification systems must not be operated by persons who have not had previous training under supervision.
16. Pool capacities and lifeguard load limits must not be exceeded at any time.
17. Check special rules and regulations for your facility with your supervisor.

Beach and Pool Regulations for Patrons

1. Children under 10 years of age should be accompanied in the water by a mature, responsible adult who has swimming ability. Height of the child or displayed swimming ability may replace the age limit.
2. At beaches, swimmers must swim between flags designating that the area is open.
3. Street shoes and clothes must not be worn on the pool deck.
4. Clean bathing suits must be worn by all swimmers. Loose threads that may cause pool filter clogging are prohibited.
5. Suntan lotions, especially in glass containers, may not be used by bathers in the pool area. Glass is prohibited in the pool area except eye glasses.
6. Soap showers must be taken by all pool users before entering pool area.
7. Smoking, eating, chewing gum or drinking bottled or canned beverages on the beach or pool premises is prohibited except in areas provided for such activity.
8. Patrons must lie or sit as far back from the pool as the width of the deck allows. (Resting to catch one's breath is permitted for short periods.) No chairs or other equipment that could constitute a possible tripping hazard are permitted on decks within 5′ of the pool edge.
9. Nonswimmers or weak swimmers must remain in the shallow water no deeper than the lower chest. When lifeguards are in doubt of the bather's ability, they must ask the individual to take the safety test (a swim across the pool and back, or appropriate distance along beach).
10. Dangerous practices are prohibited at all times. Patrons must not run on decks, climb or sit on or jump from fences or structures not provided for such activity; dive in shallow water; swim in diving area; double bounce or crowd springboard; duck, push, pull or splash swimmers. Horseplay or wrestling on decks, ladders, springboards or in the pool or dressing rooms is prohibited. Tag and horse-and-rider games are not allowed. Wheeled vehicles, except wheelchairs or baby carriages are prohibited in pool area. Over-exertion should be avoided.
11. No person may interfere with emergency operations or drill procedure.
12. Emergency signals must be observed. Swimmers must leave pool area immediately upon the signal or request of pool personnel. An emergency may exist in which all patrons may need to cooperate.

Safety hazards, costly operational errors, and limited program potential will continue to plague public swimming facilities even after design committees and managers spend large sums of money and much effort researching the proper ways to design and operate swimming areas. Preliminary plans must be thorough and give attention to all the minute details. A well-constructed pool must be operated in a well-organized and safe manner by a competent staff. Since emergencies arise only occasionally an in-service training program should be carried out on a regular basis so that the staff is ready to handle any emergency that may arise.

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Chapter 4

SAFETY CONSIDERATIONS IN POOL OPERATION AND ADMINISTRATION

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Every year millions of Americans flock to swimming pools, beaches and lakes to participate in various types of aquatic recreational activities. Not only are the numbers of people seeking this type of recreation increasing, but also the number of swimming facilities is becoming greater. In an article, "Man's Blood His Link to Love of Swimming," Olin's editor (8) says this should not be surprising for man's yearning for the sea and water began millions of years ago. There is a strong relationship between man and water. Life began in the water and man literally has the sea in his blood. Man has been aquatic minded since these earliest times. However, for centuries swimming and bathing were considered unhealthy and dangerous. As a result swimming did not become popular again until more recent times. Before the 1900's swimming took place for the most part in the natural waters, but as cities grew and their natural waters were taxed to their limits or polluted, people turned to man-made swimming pools. So it began in this century, an ever-increasing growth in the building of man-made swimming pools with a phenomenal spurt in the last 15 years. According to the Swimming Pool Industry Market Report (11) in 1971 the total estimated number of pools in the ground in the United States passed the one million mark. The greatest growth has come in the construction of residential pools. However, other types have not lagged too far behind as reflected in the 1975 Market Report (12) when it was estimated that 91,500 pools were built of which 76,600 were residential and 15,900 were non-residential.

This tremendous growth in swimming facilities and programs brought additional opportunities and a greater number of recreational participants. These increasing numbers placed a heavy burden on all those who are responsible for the safety of swimmers. Despite the tremendous growth in swimming activity, in 1975, the National Safety Council reported (7) that drownings from swimming have shown a relatively constant or slightly decreasing figure in the last 15 years. This kind of evidence indicates the tremendous task that agencies, organizations and schools have accomplished in educating the people of this country in water safety. The amount of progress that has been made toward the goal of water safety consciousness for the total population is very significant but we must avoid any tendency to become complacent because the task of reducing accidental deaths by drowning to the barest minimum is still in its beginning stages. Approximately one-half of the deaths which occur each year by drowning could easily have been prevented. Many drownings are largely the result of inadequate supervision, lack of swimming ability or poor judgment under a myriad of conditions. Many of these fatalities can be eliminated with consideration of safety-first in the design of facilities, all-inclusive learn-to-swim and lifesaving programs and improved supervision at all water recreational areas.

Definition of Public Swimming Pools

The public recreational swimming pool includes all those above and in-ground pools that are governmental, school, commercial, club, motel and hotel owned and that are used by the public at various times for recreational swimming.

Public beaches, which include lakes, rivers and surfs, private residence pools and undeveloped swimming areas will not be dealt with in this chapter because each has its own unique characteristics and safety requirements. The phenomenal growth in numbers and the specialized safety requirements of each of these areas demand separate treatment. For example, at the Southern California beaches, in addition to lifesaving duties, modern marine safety officers and lifeguards must be trained to handle a wide variety of highly specialized and skill-related functions, such as rescues, underwater search and recovery, cliff rescue law enforcement and paramedical first aid.

Safety in Design and Construction

Many safety hazards which trouble the aquatic administrator can be eliminated by providing a well-designed and constructed swimming facility. Specific dimensions and the actual shape of the pool are determined by the requirements of the program to be conducted in the pool. The problem of trying to meet all program needs continues to confront pool designers. However, pool designers should follow recommendations established by several governing and regulatory bodies. These include the competitive swimming groups, American Public Health Association, whose joint committee has prepared a booklet, *Suggested Ordinances and Regulations Governing Public Swimming Pools*, (2), local and state health codes, and the National Swimming Pool Institute (NSPI) which has published suggested standards to guide pool builders in the planning, design and construction of swimming pools. Before any construction is begun, pool plans should be thoroughly checked to eliminate any safety hazards. Correcting mistakes afterwards may become very expensive. Somewhere in the initial planning stages it would be wise to engage a pool consultant. Also, visits to other communities or schools that have similar facilities should be made to see first hand the best practices. These procedures can help in eliminating or correcting many possible dangerous situations.

The questions of how large to make a pool and still have it a safe manageable facility has perplexed planners for years. It is the viewpoint of pool experts that when the capacity of a pool complex (pool and deck areas) exceeds 2,500 persons, it creates a serious safety problem of management and supervision. Rather than construct a larger facility, it is believed to be better to think in terms of a second pool in another location.

The following list contains some of the more important requirements pools must meet if they are to serve recreational swimming needs and make the pool a safer and more manageable facility:

1. A considerable quantity of shallow water; up to 80 percent should be less than five feet deep.
2. Steps should lead from the deck into the pool to accomodate the handicapped and elderly. Hand rails should be included to make it possible for them to navigate the steps.
3. A capability to maintain a water temperature of 80°F (27°C) except when air temperature is 90°F (32°C) or above: then a cooler water temperature is desirable.
4. Provision for a deep water well separate from the swimming area for regular diving.
5. Special ramps on the pool deck for handicapped children and adults.
6. The ratio of deck space to water area should meet the minimum recommended occupancy design factors. In many situations pool size has been regulated by the occupancy limits. However, recent studies have shown that the total area of the entire complex must be considered in determining the required pool size and its safety limitations. The supervision

available, the method of instruction, and the nature of the activities to be conducted are factors which must be taken into consideration.

There are other important safety guidelines with respect to design and construction of a public swimming pool.

Provide adequate parking and safe pedestrian access to and from the pool. The potential automotive and pedestrian traffic to be generated by the pool facility should be carefully considered and adequate allowances made for the safety of the users. The pool should be so designed that emergency and supply vehicles have convenient access to the pool enclosure, filter room, storage room and bathhouses.

The entire area of an outdoor pool complex should be protected by a fence, wall or natural barriers at least six feet high. Access to indoor pools should be such that traffic should not be required to pass through hallways and other sections of a building to gain entrance to the pools. Doors should be located so that maximum security and safety may be obtained.

Safety considerations should be carefully considered in planning and designing the bathhouse and its auxiliary services. The deck of the pool and the floor of the bathhouse locker rooms should be at the same elevation. Floors of the pool deck and shallow areas of the pool as well as shower, drying, toilet and locker rooms must be constructed of non-slip materials. Abrasive ceramic tile or roughened concrete surfaces can accomplish this. Concrete floors in wet areas should never be troweled smooth since such treatment makes them slippery and therefore hazardous. When a floor area is hazardous, non-slip carborundum and emery additives should be applied directly to the concrete finish. The use of a non-slip nylon rug can also be used in these instances.

A well-equipped first aid room is essential for any pool bathhouse. It must be located where it is accessible from all sections of the pool, while also providing access from the street for ambulances. Communication to this room from all areas of the pool and the outside, particularly to a nearby hospital, is vital. With small pools, it may be necessary for the pool director's office to double as the first aid room.

The filter and mechanical equipment room must be separate from areas of public access and yet be convenient to all maintenance facilities. Generally the functions of the utilities, combined with those of the pool, such as heating, electricity and water operate from the filter room. The room must be adequately vented and fire retardant. If chlorine is used for pool sanitation, the chlorine room should be located in a separate sealed-off area from the filter room. This room should have a fan with heavy duty motor that runs continuously. Fan and chlorine room should be so located that in the event of a chlorine leak, fumes will not be dispersed over the pool area.

Depth markings and signs in many instances represent the only means of continuously communicating with the pool user. Therefore, all safety markings in and around the perimeter of the pool should be installed during construction of the pool. Markings should be specified on the (pool's) construction plans and should meet local and state regulations as well as other recommended standards such as those advocated by the professional aquatics organizations (N.S.P.I., A.P.H.A. and C.N.C.A.).

Depth of water markings must be placed on the deck near the pool edge and on the vertical walls of the pool, except deck-level pools, where the pool wall is below the water level. Depth markings are particularly important at the break point (between shallow and deep water) and must be located exactly at the break point with the *exact* depth of water at that point. Markings should be in a contrasting color (black or dark blue is preferred: red acceptable) and should be at least four inches high with six inches preferred.

To aid underwater swimmers in seeing the break point, a black line two inches in width (4 inches preferred) should be placed on the bottom of the pool 12 inches from the break point of shallow to deep water. To help swimmers determine relative depth in pools that do not have

racing lanes for competitive swimming, it is recommended that a line be placed along the bottom of the pool an equal distance from the sides to provide users with a visual image of the contour of the pool's bottom. To aid in the safety of the swimmers as they approach the pool walls in deck-level pools, the top edge of the pool at the sides and ends, should be finished in a contrasting color to the background and/or adjacent surface. (Black and red are recommended). In the recessed type overflow this would be at the lip of the overflow. In skimmer-type pools, the tile band at the top of the pool wall should have a contrasting color.

The steps should be recessed into the sides of the pool wall and should have a black or red band 2 or 3 inches wide to facilitate identification for the safety of underwater swimmers and those entering or leaving the pool by these steps.

Signs should indicate in large letters on the deck or coping where diving is not permitted in a pool.

Where pools have a ledge for standing at the sides of the deep water end, a contrasting color should be painted on these ledges so that the recess is readily visible to swimmers and divers.

Many authorities feel that a water slide has no place in a swimming pool. From the standpoint of safety alone, this may be true, however, the same argument can be said about diving boards and other swimming appurtenances when not designed or supervised properly. Water slides should be located in deep water and supervised at all times. This, of course, implies that all slide users must be good swimmers. Where slides are placed in shallow water, five feet or less, only feet-first entries should be allowed. There should be at least 16 feet clearance in front of any slide and eight feet on either side. Whenever slides are used, careful directives should be given to all users through both verbal and posted instructions. Water should always be constantly run or sprayed on the slide to prevent possible skin burns.

Wading pools for small children should be separated but adjacent to the shallow end of the large pool. They should be designed for the comfort and convenience of youngsters below the age of six years. The recommended water depth is 0 to 15 or 18 inches. A complete kiddies play pool should include an apron 6 to 10 feet in width or a walkway surrounding the pool. The entire area should be enclosed with a barrier such as a 3-foot chain link fence (knuckle-finish top and bottom) or a masonry sitting wall for parents or others accompanying the tots.

Recommended guidelines to follow in design and construction of the diving tank are extremely important to follow. An improperly designed diving tank can create many dangerous hazards which can be very costly to change later on.

The minimum number of springboards should be one low board (one meter) and one high board (three meters). All diving equipment should be installed and maintained to conform to regulations. The recommended dimensions for design, construction and installation have been established by several aquatic organizations and can be found in the C.N.C.A. publication, *Swimming Pools – A Guide to their Planning, Design and Operation*, Third edition. (5) F.I.N.A., A.A.U. and N.C.A.A. dimensions are all given in this reference guide. All three groups for the most part are in agreement concerning depths and distances.

Distance and depth of the diving tank at various points, clearance between diving boards, overhead clearance, distances from the plummet to the pool wall ahead, side wall and back wall must be considered carefully to protect the good as well as the poor diver. These dimensions are a vital safety consideration for all those who use the springboard diving facilities. Type, length and performance quality of the diving board also will determine the actual water depth and forward distance needed.

Other safety considerations with respect to diving boards are: Surfaces must have non-slip material on them and should be cleaned regularly; take-off ends of metal diving boards must be equipped with protective safety pads to prevent serious injury to divers who might strike the board; adjustable type fulcrums should be designed for easy movement. Any gear mechanism used should be covered. The orientation of the boards with respect to the sun is another

consideration for safety. The best orientation is one that allows the divers to face north or east as they prepare to dive. Boards should be placed dead level with the water — not tilting upwards. When a board tilts up, the chance of a diver coming down on the board is increased. Handrails should be placed on all diving stands. The safest and best design to date is one where the sides are entirely closed with canvas or a similar material. Where the design does not include closed sides, one or more center rails should be provided so that no opening is greater than 12 inches. Handrails should extend at least two feet over the water toward the board tip. Steps are safer than vertical ladders and should be strongly considered in the initial planning. The angle of the steps should not be more than 50 degrees from the horizontal and the treads, six inches deep, should be finished with a non-slip material. (Additional specifications for diving boards and areas are included in Chapter 5 and 6 of this monograph.)

Lifeguard chairs are desirable features at all public swimming pools and are required by law in many areas. Where lifeguard chairs are mandated, there is usually a specification for the proper number of chairs. The number of chairs needed in any pool and their location will depend on the size of the pool and the amount and location of deep water (over five feet) and the number of diving facilities. Generally, no less than one chair should be provided for every 2,000 square feet of pool surface. When more than one chair is provided they should be on opposite sides of the pool. In outdoor pools, the pool lifeguard chairs should be so located that the sun's rays are to the back of the lifeguard during most of the busy part of the day, minimizing the sun glare and reflected light from the water's surface. Umbrellas over the lifeguard's chair and sunglasses will help reduce glare. Chairs should be elevated from four to six feet above the deck and stable to permit the guard to dive or jump from it in case of an emergency. In large outdoor pool complexes, chairs should be equipped with intercom systems to enable all staff to be in immediate touch with one another.

All electrical wires and fixtures in and around the pool must meet the standards of the National Electrical Code, as well as the codes set forth by the respective states. In Pennsylvania, all bathing places require an electrical inspection every three years with the inspection certificate displayed in a location. Electrical wiring leading to light poles should be placed underground in conduit. All conventional and high voltage service receptacles accessable from the pool deck should be waterproof, resistant to chlorine and be key-operated and ground-fault protected. Underwater lights must be installed in accordance with Article 680 of the National Electrical Code; however, where state laws are stricter, these requirements apply. Electric hair dryers should be located in a dry area of the locker room and a bathhouse individually ground-fault protected. There should be rubber mats underneath them for users to stand on.

Safety Practices in Pool Sanitation

Regardless of its purity, the water used to fill a swimming pool must be filtered and treated chemically to make it safe for swimming. One of the major responsibilities of a pool administrator or manager of a swimming pool is to provide clear, bacteriologically safe water for pool users. To do this requires a knowledgable person with training and background in pool chemistry. Today more and more communities and localities around the country are requiring pool operators to attend a prescribed program of training and certification. In some sections of the country, certification is mandatory to operate a pool. Suffice it to say, the pool operator should be thoroughly familiar with pool chemistry and sanitation methods. There are many good sources on pool chemistry, but one outstanding publication was written by Thomas (13). Because this subject is so vast and complex only the major considerations concerning safe sanitary practices in swimming pools will be considered here.

Each state and many local governments have their own health codes with respect to pool sanitation. Pool operators should be thoroughly familiar with these local and state laws.

Swimming pools should be provided with a recirculation and filtration system with a turnover rate every six hours. Wading pool water should be completely circulated every two hours. The filter system should be a continuous 24 hours a day operation whenever in use. Clarity of the pool water is acceptable when a disc (4-6 inches) of contrasting colors placed on the bottom is clearly visible in the deepest part of the pool. Clarity of water is not necessarily related to its sanitary condition. However, it is a factor in a safe swimming environment. When water lacks clarity, it indicates chemical problems and should be tested for algae, fungi or excessive amounts of iron or other chemicals.

Pools should be continuously disinfected by a chemical, which provides an easily measured, freely available residual effect. Chlorine, bromine and iodine are most commonly used for controlling bacteria in swimming pools. Chlorine and bromine can be introduced into water in the pure form or in the form of compounds that release them when mixed with water. Iodine is usually added as a compound. Chlorine is still the most widely used and the only disinfectant acceptable by some health departments. When a disinfecting agent begins to react with bacteria in the water it oxidizes or "burns-up" these impurities. If more than enough of the disinfecting agent is added to react to all the impurities initially present there will be an excess remaining called residual (chlorine, bromine, iodine). This residual chemical may be in its "free" form (free residual) or combined with another chemical (combined residual). Some combined forms will kill bacteria, but the uncombined or free residual is much more effective.

When chlorine is used, a free residual of .6 ppm (parts per million) is necessary to assure safe pool water. A free chlorine residual of 1.0 to 1.5 ppm is recommended by many authorities.

Test kits for free residual and pH determinations are essential items for pool operation and should be provided for every pool. The most common method for testing chlorine residual is the orthotolidine dye test. Orthotolidine reacts with chlorine to form a yellow-green color. The comparative color test for free chlorine residual should be taken immediately after mixing. Care must be taken to use the same disinfectant vial each time. Mixing pH and disinfectant vials can give false readings.

Most states recommend that pool water be kept at a pH range of 7.2 to 7.6 (slightly alkaline). Accurate control of the pH of swimming pool water is essential. A drop in the pH below levels of 7.0 (neutral) will result in eye irritation, chlorine odors and possible skin rashes. Control of pH is relatively simple by the addition of sodium carbonate to the water. The three most commonly used dyes or indicators are bromthymol blue (pH 6.0 to 7.6) phenol red (pH 6.8-8.4) and cresol red (pH 7.2 to 8.8). Phenol red indicator kits are the most widely used. Thoroughly cleaned vials are essential for accurate tests. PH water tests should be taken at regular intervals and permanently recorded. In normal swimming pool operation the time interval between tests should not exceed two hours.

It is a well known fact that water can be a major factor in the transmission of disease. Consequently, local and state health departments require periodic bacteriological tests of pool water. The procedures for testing water for bacteria are complicated and time consuming and are accomplished by approved state or private testing laboratories. The chemical laboratories incubate the water sample for 24 hours in a nutrient lactose broth or in agar.

Overflow facilities (gutter system) should be provided and water levels in the pool maintained to effectively remove scum, debris or other floating matter.

The bottom, sides, decks and other surfaces should be kept free from dirt, slime and algae to provide a clean, safe pool free from disease and dangerous slippery conditions. A regularly scheduled brushing and vacuuming system and super chlorination at intervals will generally prevent these problems from starting.

Many pool chemicals are dangerous and the manufacturer's recommendations should be followed. Storage of chemicals should be in a room that is dry, free of moisture and well ventilated. Where chlorine gas is used the gas cylinders should be housed in a mechanically

well-ventilated room. All cylinders when in use on the platform scales or in room storage should be in an upright position and chained or strapped to a wall bracket. A motor-driven exhaust fan must be included in this enclosed room, capable of a complete air exchange in one to four minutes. The chlorinator system and all tanks should be checked daily for leaks. A small amount of ammonium hydroxide on a piece of cloth will produce white smoke in the presence of chlorine. A red illuminatory light and fan switch should be mounted outside near the door entrance for control and safety purposes. As an added precaution in an emergency, a gas mask should be conveniently stored outside the room.

Safety Practices in Pool Administration

For a pool to be safe, it must be properly administered. Good management involves many intricate functions that require careful preparation in order to result in safe operation. The pool manager's concern for safety is evidenced by the policies he establishes and the decisions he makes with regard to his staff and the patrons who use the pool facility.

Prior to the opening of a new swimming pool facility, limits for swimming loads should be established and enforced when the pool is in operation. An overcrowded pool on a hot day is unsafe and uncomfortable for the swimmer. There are a number of suggested standards for determining swimming loads. In Pennsylvania, the code states the number of bathers permitted in any artificial swimming pool at any one time shall not exceed one bather for each 25 square feet of water surface area of the pool. The National Swimming Pool Institute suggests a load limit of one person per 20 square feet of pool and deck combined. The Los Angeles Department of Recreation and Parks allows 15 square feet per swimmer in shallow water and 30 square feet per swimmer in deep water. The pool administrator should determine his pool capacity before the season opens, based on state and other recommended standards, as well as his local pool layout. An equally important consideration with respect to swimmer load is the number of lifeguards needed. A good policy is to require a minimum of two lifeguards on duty at any time the pool is in use. Here, too, the standards vary. In some areas of the country the standard of one lifeguard for each 2,000 square feet of water surface is followed. The Pennsylvania Code says at least one qualified lifeguard for each 75 bathers. Generally, it is the accepted practice around the country to provide one lifeguard for 100 to 125 swimmers.

Safe conduct within the pool area is another important administrative consideration. Obviously it would be difficult to agree on a single list, but the following list should provide guidelines for a desirable set of safety standards upon which most pool administrators can agree. Many of these listed safety regulations should be posted in strategic locations around the pool area.

1. Running should be prohibited in the pool area.
2. Swimmers should refrain from talking to the lifeguards.
3. Expectoration should not be allowed in the pool or on the deck.
4. Glass of any kind should not be permitted in the pool area.
5. No "horseplay" in the pool area. (This is a general regulation or a "catch all" phrase, and gives the staff the flexibility of judgment to stop any action by pool patrons that is considered unsafe.)
6. Swimming should not be allowed during electrical storms.
7. Persons suspected of being under the influence of alcohol or drugs should be barred from the pool area.
8. Any person with open wounds, sores and skin infections should not be permitted to swim.
9. Rules and regulations concerning the use of various floatation devices should be considered. These devices should be prohibited in deep water areas.
10. Showers should be taken before entering the pool or some system of inspection before entering should be utilized.

11. Rules and regulations concerning the use of diving boards should be posted in a prominent place. These should include the following:
    a. Only one person permitted on the diving board at a time and only one on the steps leading to the board.
    b. Double bouncing oneself or another person on the diving boards should not be permitted.
    c. Hanging from the boards should not be permitted.
    d. Divers should be instructed to wait until the preceding diver has surfaced and cleared the immediate area before diving.
    e. Diving should not be allowed from the side of the springboard and depending on the design of the area, diving from the side of the pool in the diving area should be prohibited.
12. Pools with slides should consider regulations against sliding down head first, feet first on stomach, standing on feet or knees, playing under the end of the slide and attempting to traverse up the slide.
13. Regulations should be established concerning the use of masks, fins, snorkels and underwater breathing apparatus (Scuba equipment). Most public pools prohibit use of such equipment during recreational swimming hours but, do set aside a certain time of day when it may be used for classroom teaching and practice.

In conjunction with the rules of safe conduct, it is extremely important for pool staff members who are responsible for enforcing regulations to understand the reasoning behind each regulation. Being able to explain specific regulations to pool patrons with good logic can be helpful in the safe, smooth, operation of a pool facility.

Specific daily maintenance procedures should be established by the pool administrator. All parts of the pool should be routinely checked for safety hazards. This is best accomplished by assignment of various tasks to be performed by designated staff members. The daily maintenance routine is essential both to the efficiency of pool operation and to the health and safety of the patrons.

The usual daily functions are:

1. Visual inspection of pool's water, equipment and supporting facilities
2. Chemical analysis of the water
3. Taking water sample for bacteriological analysis
4. Thorough cleaning of bathhouse
5. Cleaning pool deck and inspection of grass or beach area for sanitary and unsafe conditions
6. Brushing of pools walls and vacuuming of bottom
7. Check of filtration system for normal operating conditions

Permanent daily records should be kept on the pool's condition using forms designed for this procedure. The forms can serve legal purposes as well as a reminder of items which may be forgotten or need attention.

Providing adequate safety equipment is another important consideration. Most state codes require a minimum of lifesaving equipment to be readily accessible at poolside.

Minimum equipment should include:

Reaching aids such as bamboo or aluminum poles, 12 to 14 feet long, two ring buoys at least 18 inches in diameter attached to 25 feet of strong nylon or manila rope, and a standard first-aid kit filled and readily accessible for emergency use. If the pool has shallow and deep water, certainly a buoyed life-line at the five-foot breakpoint should be installed. The line signals deep water warning to the nonswimmer as well as providing a temporary safety support if needed by the tired swimmer. Latest life-saving practices indicate that the rescue tube is an excellent rescue device and could be used in place of the ring buoys.

Strong consideration should be given to additional safety equipment beyond the minimum. This should include a backboard and a mechanical resuscitator. If this equipment is at pool side or in the first aid room, it is imperative that the entire pool staff be properly instructed concerning its use. The first aid room should also be equipped with a cot, stretcher, and blankets.

Certainly, the need for adequate rescue equipment cannot be overstressed. It can be simple and homemade or purchased commercially. In either case, the choice and amount of safety equipment will depend upon the type of pool, water conditions, funds available. The knowledgeable administrator should be aware of the latest safety equipment available for use.

An additional and valuable safety feature is an intercommunication system. A public address system for enforcement of rules and emergency control (with microphone plug-in at all lifeguard towers and pool director's office) can be a very valuable safety feature. The system can serve many uses other than the emergency rescue situation such as: direct contact with the pool director if an unsafe condition exists, a discipline problem, or to rotate guards. If such an electronic system is not available, there are other means of being able to communicate through a system of bells, buzzers, telephone, hand signals, *etc*.

Safety Practices for Pool Staff

If there is any key to a safe swimming pool, it is the quality performance of staff personnel. Quality performance for a safe efficient operation can be achieved by good pre-season preparation, and periodic training throughout the season or year.

Any administrator who operates a swimming pool should establish qualification standards for each staff position. Generally, the basic standards for each position would include age, certification, personal and professional recommendations and experience. Obviously, there will be other requirements for various staff positions based on the level of responsibility and nature of the work. Selecting personnel based on established standards will not guarantee a safe pool operation, but it is a step in the right direction.

When offering a position to a prospective staff member, a complete job description should be given to them. This procedure can prevent misunderstandings or negative attitudes that might develop later on. (It also gives the individual the opportunity to decline the offer, which perhaps is better than having a disgruntled, unhappy staff member all season).

Once qualified staff have been hired, a pool manual or program guide should be distributed to each staff member to familiarize them with policy, procedures and regulations. This should be done before the staff meeting and training sessions so that any questions or misunderstandings can be cleared up. Suggestions should be encouraged and graciously received throughout the season in a continuous evaluation of policy, procedures and regulations.

Staff training should begin before the pool opens and continue throughout the season on a periodic schedule. Safety training of lifeguards on a regular basis helps to prevent laxness and maintains peak efficiency.

A basic lifesaving or water safety instructor certificate does not guarantee qualification as a lifeguard. Lifeguarding *per se* embraces more than the basic skills, and in many instances pool administrators require additional swimming tests to qualify, as well as review training sessions to share knowledge and experiences one does not receive in most agency certification programs.

There are several good manuals which describe the conduct of lifeguard training programs. The Council for National Cooperation in Aquatics', *Lifeguard Training: Principles and Administration* (4) and the Y.M.C.A's Manual, *National Lifeguard Manual* (14) are excellent sources for developing and administering lifeguard systems for pools. Training in poolside first aid should be an integral part of the lifeguard training sessions. These should include the latest methods and procedures for C.P.R. and spine board use, as well as the review of standard basic first aid practices.

Regulations concerning emergency procedures for a water rescue should be established for all staff members. Guards should be instructed and have a definite emergency procedure to follow in making a water rescue. The emergency procedure would involve not only the water

rescue, but the continued safe operation of the pool at other areas while the rescue and first aid is in progress."

The lifeguard's work schedule is another important safety consideration. Keeping alert is the most difficult task for a lifeguard. Pool operators can use various devices to help maintain alertness and morale. Rotate the guards on duty every half-hour. Provide a 10-minute rest period every hour. Permit no lifeguard to work more than an 8-hour day with at least a one hour break at the mid-point of this 8-hour work day. Guards should have at least one full day off a week. Arranging for a brief 3- or 4-day vacation during the season is a good management practice, if qualified and experienced personnel are available as replacements.

Summary

Good safety practices should be followed from the time the decision is reached to construct a swimming pool.

There are no easy solutions to the safety problems and dangers that are created by improper design and construction of pools or poorly trained and uninformed administrators. Pool architects, engineers and administrators involved in planning and operating pools should be cognizant of their tremendous responsibilities and include the best safety practices known to the industry and profession.

Lack of knowledge and experience coupled with the tremendous growth and interest in aquatic activities has compounded the safety problems. Only through trained, qualified and knowledgeable people, with dedicated effort and hard work can solutions to these problems be acheived.

However, it must be emphasized that good safety practices must be followed without sacrificing or detracting from the natural enjoyment derived by participants through excellent, well-planned facilities and program.

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Chapter 5

SPRINGBOARD DIVING

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To climb, to be above, to fall through space and plumb the cool depths — what youngster does not feel this tremendous desire at some time? Those daredevils who must test fear, who find exhilaration in uncertainties of outcomes, cannot pass up an opportunity to jump off a big rock into the lake, to swing on an old tire over the river in spring flood, to dive from the old tree into the inundated quarry.

Accompanying the aspects of courage and agility and glee involved in "jumping off," is risk of accident. In the swimming hole environment this risk is expected, and perversely, is a part of the attraction. Safety standards are not uppermost in the mind of the ten-year-old "showing off." Accidents are in fact somewhat infrequent, perhaps because confidence breeds assurance and good timing, and hesitations of caution do not unbalance the surefooted. Accidents when they *do* happen can be very serious.

When aerial desires are put into the framework of organized sport, they are channeled into springboard and platform diving. Standards of safety for equipment, supervision and teaching have come a long way since the early part of this century. Proper progression, sensible conditioning and an alert coach can prevent most diving accidents. The accidents which are difficult to predict are those of psychological failure of the diver: holding back when faced with a new experience in space; "freezing up" of muscle action; disorientation in space.

On the whole, diving need be no more dangerous than any ordinary activity. The risk of accident is related to poor equipment or environment, hasty and ill-advised teaching, lack of supervision, and lack of common sense.

EQUIPMENT AND SURROUNDINGS

In analyzing diving safety we must consider the board, the diver's movements in the air, contact or impact of the diver at the water's surface, and finally the bottom of the body of water.

Bottom and Water Depth

Depth. Although the bottom is at the end of the action, it will be considered first in safety emphasis. It is by far the most potentially hazardous factor for the diver. Water depth and condition of bottom surface must be known before *any* dive is performed, be it poolside, dockside or cliffside. The results of carelessness in this respect can be broken shoulders, broken necks, paraplegia or quadraplegia.

Pool owners with substandard depths for diving must realize the consequence of allowing boards to be used by any individual. No one wishes to cause any accident, much less be responsible for permanent paralysis or death. Liability for injury in shallow pools is a very realistic possibility. In many cases it is better to remove the diving facility and thereby force safe construction.

Pools with diving boards were constructed over water seven or eight feet deep in the first three or four decades of this century, and much of the time that depth encompassed only a very minimal landing area. Some of these pools are still operating with diving equipment, but they are not safe. To justify the original premise of what we now consider unsafe depths, the old diving standards for a "good" dive were not nearly as vertical nor as close to the board as today's standards. Also boards were probably half as resilient as today's equipment. Both of these factors would have lessened the impact of the diver on the bottom in the past.

The experienced diver in newer pools today is accustomed to boards of great flexibility, sending him higher in the air than the old boards. He is also used to modern competitive depths: 12 feet for one-meter boards; 13 feet for three-meter boards; 17 feet for ten-meter platforms.[a] These depths should include general landing areas of sufficient dimensions for safety. (Figure 1)

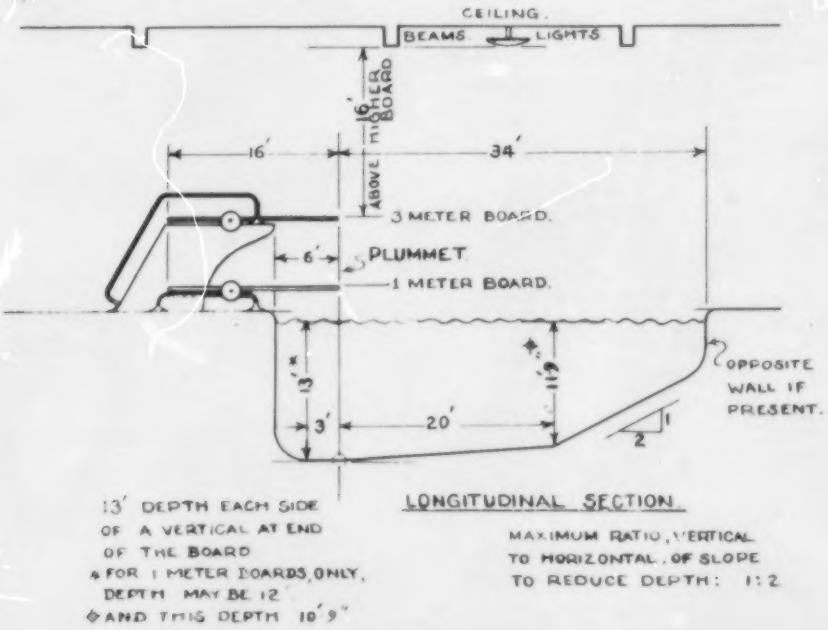


Figure 1: Dimensions from Side View

If the water is not at the proper recommended depths, the diver may be subjected to certain injuries such as sprains involving the lower back, wrists, ankles or knees, occurring when contacting the bottom, or in trying to avoid bottom contact. Hard impacts may cause hand or foot contusions, lacerations, head and neck injuries, or loss of teeth.

The problem of shallow depth does not bother the beginner as much as the better diver. When a dive is well executed, after entry a diver goes to the bottom in a direct line with much less resistance than the splashy entry of the novice. The experienced diver is probably accustomed to proper depths and may be in real trouble trying to cope with an unfamiliar shallow water situation.

[a] Specifications mentioned throughout this chapter have been compiled from national competitive rulebooks (1, 2, 3, 4).

The novice or beginner is not exempt from hazard. Normally his attempts may result in sloppy, off-angle entries, but he can by chance make a near vertical entry and crash unexpectedly into the bottom. This may catch him completely unprepared, with arms relaxed leaving the head and neck vulnerable. There are several precautions which help in the shallow water situation, and in fact should be followed by all divers, whatever their skill levels:

1. All divers should be taught how to land correctly on the bottom.
2. Divers should be familiar with their own facility's size and shape.
3. Divers should be warned to try out all facilities new to them with extreme caution until they become acclimated to differences in depth or shape.

To land correctly on the bottom, one lands on the palms of the hands, controlling the falling weight with arm and back muscles, lifting the head to clear the bottom. Very hard hits take more arm strength to control the fall, and sometimes the diver contacts the bottom with trunk and thighs, thus spreading the impact force. For a foot-first entry the principles are the same as for landing from any height: controlled flexion at ankles, knees and hips.

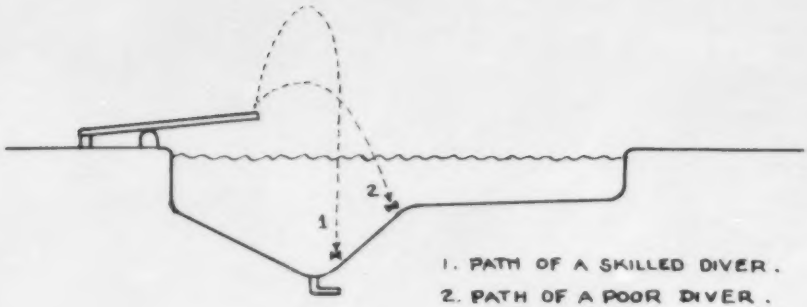
"Saves" for advanced divers normally keep the diver relatively shallow, since the skills involve rotation of body parts just under the surface of the water. This counteracts problems of bottom contact with some exceptions: in quite shallow water, the "save" may lead to a knee pull into the bottom, or a head-neck-back contact as the body rolls.

Divers develop a sense of time interval between the second they touch the water and the second they contact the bottom. This they develop in their home facility if they dive frequently. One problem for the diver is the need to dive in a pool shallower than his own, usually for a competition. The youngster used to 12 feet of water beneath him suddenly practices or competes in a nine-foot depth. At nine feet his arms are relatively relaxed, as he unconsciously expects three more feet of fall. If it is necessary to dive in a shallow water situation, it is the coach's responsibility to warn divers to get accustomed to the depth. In some situations it is wise to swim to the approximate entry point, then try a foot-first surface dive with arms overhead to "measure" by feel and by sight the length of the diver and the depth of water. Fall into the water from the board a few times, without a spring; and then take a few standing dives. After these procedures the diver should be more aware of the bottom. The coach hopes that he has "re-set" his time interval reaction. Yet even with all precautions, there is the gamble that in the concentration of competition, the dive will be uppermost in the diver's mind, and the dive termination problem forgotten until too late.

Shape. There are often problems in shape of bottoms, in particular "spoon" bottoms and their variations. Not only do these involve a shallowness where a diver will logically go, but also may include a drain at the deepest point; under the board. This can create a hazard of catching a finger or toe as well as an abrasion problem if the edges of the drain are uneven. The backyard pool and hotel-motel pools are currently the chief offenders in problems of bottom shape. (Figure 2)

Despite the best of intentions, pools have been built which do have good depth only to have this nullified by a very sharp rise on all sides of the deep spot, or even just ahead of the deep spot. Very specifically stated in N.C.A.A. and A.A.U. diving rules (2:6; 4:38-39) is a maximum slope (ratio of vertical rise per horizontal unit of distance) to reduce depth as well as the distances the safe depth should remain constant.

Surface of bottom. Bottom surface problems of slipperiness or roughness are caused by poor maintenance or by inherently slippery materials. Pools which have built-in wide tile lanes can be hazardous for divers. Occasionally the problem is roughness, caused by new curls of cement, uneven seams in metal pools, or uneven tiles. In natural environments, the bottom surface problems are more numerous: rocks, reeds, soft mud, shells, sharp stones, and littered areas with the chance of broken glass, cans, fish hooks, old anchors. Camp and outdoor



A COMMON BACKYARD OR MOTEL POOL.

Figure 2: A Common Backyard or Motel Pool

recreational facilities must be carefully inspected at the beginning of each summer season. The fact that lake and salt water areas are sometimes murky and dark makes it even more essential to know exactly what is on the bottom.

Another important aspect is equipment placement which often creates an obstruction beneath the surface. These include uneven rock ledges in quarry sides or any rocky creek; poorly constructed floats or piers with protrusions; ladders eroded by water and weather; anchor chains or guy lines from floats which vary in position with wind and tide, and sometimes lie directly under boards.

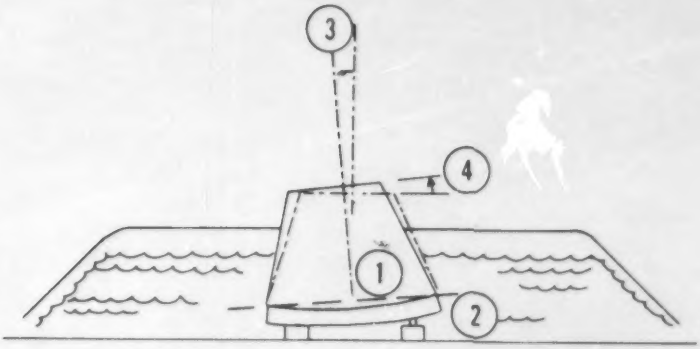
The best diving area is the separated or separate diving pool, such as are available in "L," "T," or "Z" shaped pools. These allow for deep water space not involving any swimmers and constructed specifically for diving.

Board

Access to board. Even before considering those things which involve safety in a diving performance from a board, see that the procedure for mounting the board is safe. All boards are set above pool deck and the diver must climb steps or stairs to get to his starting position. Proper handrails should be provided for boards higher than one meter, and steps should be sufficiently wide, deep and not slippery.

Strangely enough one-meter platforms (for springboards) are often the chief offenders in discomfort and/or safety, where round, slippery piping is so frequently the only spot to place one's foot to get up on it. If this is the only structural possibility, at least the stepping surface should be covered with non-slip material.

Installation. Safety of boards concerns the surface, stability, pitch, and position in relation to surrounding walls and other equipment. Boards should be anchored firmly at the fixed end with bolts through the deck or substructure. The fulcrum should be properly centered, level, and at exact right angles to the board. The pitch of the board should be level, or no more than one inch above the horizontal at the tip. If the fulcrum is adjustable, the mechanism should be such that the pitch of the board is not affected by different positions of the fulcrum. An upward pitch can cause a diver to take-off at too straight an angle and come back down on the board. It can also bother a diver not used to this pitch so that his timing is disturbed and he mistimes his take-off. A downhill board is also difficult to control. The diver's tendency is to be thrown out and over, or, if he overcompensates, to take his dive up too straight.



1. Board Warped.
2. Anchor Loose or Rusted.
3. Board Not in Line With Pool.
   Cause 1, 2, or Fulcrum Not
   Level, Tight or Square, or
   It Is Broken.
4. Board Twisted.
   Cause 1, 2, 3 or Warped.

Figure 3: Board Alignment Problems

All fittings should be checked for tightness. Loose fittings may cause a twist in the board, throwing the diver to one side (and incidentally shortening the life of the board). If the board is allowed to slip a little to one side of the fulcrum and is no longer at right angles to the pool end, this will place an abnormal stress on the board and the fulcrum equipment. A moveable fulcrum which tends to stick from lack of lubrication or faulty alignment of rolling gears may also distort board alignment. It is very unwise to mount a new board on old fittings which were not designed for that board. This is often done for economical reasons, but there is no economy in the subsequent problems which may come with faulty or worn out underpinnings.

Surface. A slippery surface makes a diver apprehensive, and very definitely disrupts his take-off coordination. This kind of worry can cause accidents: on the board or at the surface of the water when hitting it badly. It is mandatory that the surface of the board be non-slippery.

The most satisfactory type of surface is either the sandpaper-like material used on wood or fiber glass boards, or non-slip paint surface on metal boards. Cocoa matting, formerly common, becomes slippery with use, often develops holes at the point of hurdle press and at the tip. Cocoa matting can also loosen and fray. Any bad wearing at board tip or hurdle press point, whatever the board covering material, should be corrected at once to prevent falls.

Boards with any kind of attached matting cover must be watched for accumulation of algae or mold between the covering board surface. Occasional drying out is recommended. To maintain a surface such as non-slip paint or sandpaper, occasional scrubbing with a clorox solution is good. If a board becomes quite slippery, check that the solution used for deck cleaning is not causing this as it is carried onto the board surface. Diving manufacturers will also replace worn board surfacing.

Flexibility. The flexibility and timing of a springboard varies from the fast, hard bounce of a short wooden board to the deep, soft swing of the latest aluminum board (similar to the timing

of a trampoline bed). In addition to the inherent flexibility of any board, moveable fulcrums adjust board timing to the taste of the diver, to his weight and strength. Variables in flexibility of board timing are not dangerous factors in themselves. They become hazards only for the inexperienced diver. One who has had little experience on any board, or one who is accustomed to a fast bounce only, can be thrown completely out of balance when using a soft flexible board for the first time. A similar problem arises in competition when two divers following one another have very different fulcrum preferences, and the second diver fails to readjust the fulcrum. This kind of situation can cause injury from board or water contact.

The antidote here is good coaching. A diver must be educated to try out any alien board by diving with easy take-offs. He must learn what he has to do within his own timing to adjust quickly to a board which cannot be adjusted, and to check a moveable fulcrum before each dive to see that it is correctly set for him.

Space around board. Next to be considered is the relationship of the board to surrounding walls, equipment and water. First the board must extend a safe distance away from the end wall to which it is attached. If it is too close to this wall, divers may hit the wall underwater, since several dives tend to curve back toward the wall underwater. This is particularly true of inward dives, half twists and back dives. A safe distance between the end wall and board tip is six feet for all heights up to ten-meter platforms, when six and a half feet (two meters) are recommended. Other dimensions in board placement important to safety are lateral space (10 feet to 17 feet) and space directly in front of the board (30 to 45 feet). The variation in the distances relate to the height of the board, and should be checked on the official dimension charts.

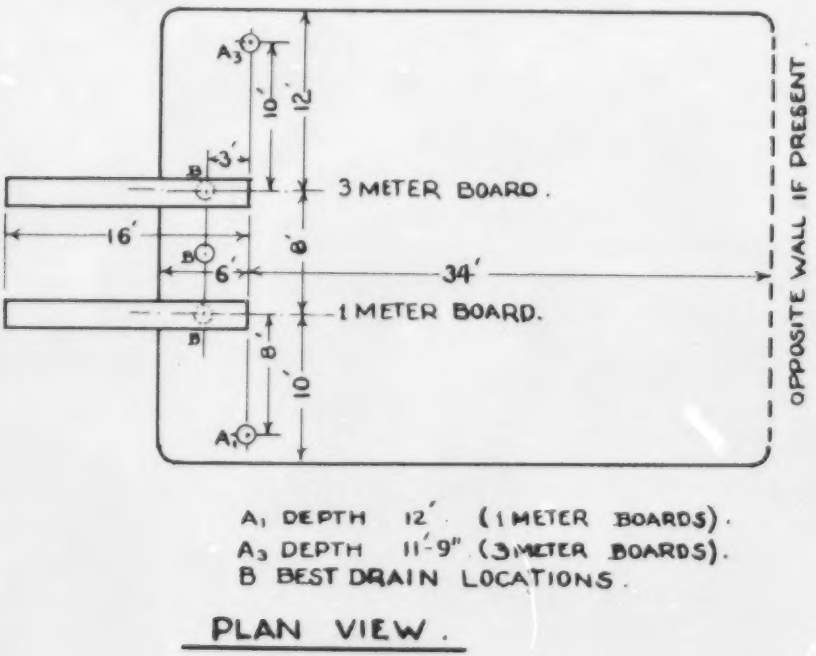


Figure 4: Dimensions as Seen from Above

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Because divers at all skill levels need unobstructed headroom, ample space forward and to the side, and safe depths, pools should not be used for diving unless its dimensions conform to minimum specifications for safety. If there is a ceiling overhead this should be at least 16 feet from the surface of springboards. Ceilings should also be free of beams, hanging lights or any other obstruction, in the path of diving (specified as 16 feet forward). It is doubtful that there have been many accidents involving ceiling contact, but low ceilings are mental hazards. They can definitely contribute to a poor dive start and cause an accident on the board or at the surface of the water.

Lighting. Related to hazards in the air, are the position and strength of lighting. A glaring light in the eyes of the diver, either at point of take-off (forward or backward) or at the peak of the dive, can be blinding. Occasionally there is a kind of lighting which causes the surface of the water to be invisible. Very calm, still water makes the surface most difficult to see. Mechanical surface agitation is therefore recommended in competitive situations, either by underwater bubblers, hoses, or the homemade procedure of having a teammate splashing the water surface.

Beautiful architectural effects sometimes produce undesired results. A wall of windows opposite a three-meter board in one situation caused a diver to mistake it for the water surface during multiple spins, and his perfect horizontal entry took him to the hospital.

SAFETY PRACTICES

Proper Supervision

Frequency of accidents will rise if children and adults are allowed complete freedom of diving equipment use without control. Experienced lifeguards know well that the area near a diving board is where they can expect trouble unless safe rules are set up and enforced. These are the common sense rules:

1. Allow only one person on a board at a time.
2. See that the preceding diver is well away before diving.
3. Dive only from the end of the board, not from the sides.
4. Never bounce from one board to another.
5. Do not bounce board excessively.
6. Do not swing by the arms from high boards.
7. Do not swim under board. Swim away from board to nearest ladder immediately after a dive.

Most of these rules are self-explanatory. In specific situations special rules can be made. There are occasions when boards should be closed because of overcrowding, small swimming areas or limited available supervision. Where there is no separate diving area, particular alertness must be maintained at busy recreational times and in joint swimming-diving practices. Coach, swimmer and diver must cooperate in sharing the facility safely. If lane lines are present for swimming workouts, they should be moved a safe distance to the sides of the board. In general the diver is responsible for checking whether his landing area will be clear, since he is above the swimmers. The coach working with the diver has to be alert to swimmers' positions, particularly when the diver is taking-off backwards.

Bouncing a board is, in many ways, an excellent practice device for the initial feel of board timing, using feet and ankles correctly, handling body balance, correcting alignment and arm swing, and just for building leg strength. However, the same thing can be practiced with the same advantages on the trampoline, and board bounding can very dangerous. Any off-balance landing can put a diver out of control, at the mercy of whatever rebound angle and force sends him — to poolside or onto a swimmer. The accumulation of force from many bounces can make this much more dangerous. Even in the process of landing on the board from the height buildup, divers have been known to sprain ankles, twist knees and break bones.

Teaching of Safety

In the process of teaching and performing diving there are specific concepts of accident prevention which make diving both safe and easy. These concepts can be divided into three areas: 1. Pace at which a diver is taught and coached (progressive); 2. Specifics which the diver learns to make him a safe performer; and 3. conditioning. The degree to which a teacher can analyze and judge a diver's performance in order to decide "pace," and the degree to which a diver can respond to his own checks and balances in movement, will determine the safeness of his diving.

Pace. Pace signifies a little more than progression. While it means building from fundamentals and being sure that basic dives are learned in logical sequence, it also has to do with how fast these things are taught, how much time must be spent by different people at different levels, and recognizing influencing factors such as unusual fatigue, time of year in academic pressure, onset of illness, outside psychological stress, parental pressure or indifference. In competitive situations pace is related to the dates of the meets. This can be very detrimental, when motivation is keen and performance may not yet be safe. Coaches and divers tend to push too hard and too fast. Weather can be a pace factor: wind and cold cause muscle tightness and strain. The discomfort and difficulty in executing hard dives under these conditions make divers hurry and become careless; it becomes difficult to feel balance and to sense proper timing.

It is a wise and perceptive teacher who can evaluate these various factors of pace in teaching. He must be constantly flexible and sensitive to everything in the environment of the diver.

Diving Specifics

Focus. Focus, or visual orientation, is a specific for every diver from a beginner onward. This means awareness of the end of the board at all times in the forward approach. It means judging angle of take-off, visual checkpoints for controlling dives from heights and dives involving great change of position, watching for the "break" from spins and twists. Every entry involves a definite point of aim. A "blind" or not-looking diver is an unsafe diver. All dives are adjustments in balance, controlling the force imparted to the diver at take-off.

Sensitivity to Balance. A good part of the adjustment mentioned above is sensitivity to balance, a second specific for every diver. From the time he begins to walk forward on the board or even when he begins his arm swing on back take-offs, he is shifting his center of gravity. If he is aware of these balance changes, he can adjust, correct and keep his actions safe in terms of hitting the board or contacting the water improperly. He learns that whatever happens, he has done it himself. Therefore, he can also change and control it. He must be made aware of balance and his specific control through his body alignment, use of feet and ankles, and position of head and shoulders.

In simple terms, the diver is taught to keep his eyes open and to have control of his movement at all times. He doesn't run madly off the board; rather he walks, hurdles correctly, and lands in balance, pressing through to his heels. He springs into an arc, actually a parabola, to land in the water two to five feet from the board tip.

Closeness to Board. In emphasizing the importance of focus and balance the teacher looks to the center of gravity of the diver as he performs. If he is passing very close to the board, his problem is in his take-off. Watch his action there and judge what it is that interrupts the logical arc which should follow a balanced, coordinated take-off.

The intent of diver and coach is not to see how close the diver can come to the end of the board, but to set a reasonable angle of take-off for optimal height within aesthetic boundaries. The dive which makes a spectator hold his breath or cry out in alarm is not the best. Comfortable distance from the board as judged by the eye seems to be a minimum of about 18 inches. The only place to judge diver closeness is directly in line with the board tip from the side. Spectators

watching from angles other than this, especially if the board is directly toward or away from them, have a distorted perspective of the board and diver, and the dive may appear closer than it actually is.

If a diver shows decided tendencies to come close to the board only in specific dives, the coach must backtrack, and teach better mechanics for those dives at an easier level. If all take-offs seem to bring the diver close, there are serious balance and timing faults involved at hurdle and/or take-off. The "close" syndrome must not be brushed off as just characteristic of that individual. Habits are being formed which will eventually lead to trouble. The time to correct these bad habits are when they first appear.

Water Contact. Contact with the water is a matter of correct dive execution which finishes going through the water at an angle slightly less than vertical, whether head or feet first. The diver who tries to dive at 90 degrees inevitably rides over as his body continues in the direction of his rotation. In addition his arms and upper body are slowed in their rotation as he enters the denser medium of water. The lower body, still in air, tends to keep on going.

Ear injuries occur occasionally among divers learning multiple twisting-spinning dives. These injuries happen when the twist is incomplete or the diver is "lost," and he hits the water squarely on the side of his head.

Another consideration related to water contact is the alignment of the arms and shoulders with the head of headfirst entries. Arms should be over the ears, together and stretched. This is particularly essential for diving from boards higher than one meter. A wide arm position may mean a hard impact on an unprotected head. Neck and shoulder injuries may occur if one arm is forced out of line. From platforms a common complaint is bruised hands, wrists or foreheads (the impact sometimes driving the hands into the head). This is prevented by a firmer stretch and a clenched fist position of the hands.

Underwater. Once underwater the beginner tends to lift his head and come up too soon, causing strain in the lower back. The remedy is to carry the line of the dive down deeper, preferably to the bottom if suitable. This means a good strong stretch and tension in the diver's position, which is excellent entry procedure anyway. In advanced diving techniques there are several alternate underwater maneuvers which, if mastered, make very clean entries or even "save" poor entries. These maneuvers should not be attempted by inexperienced divers since they require a high degree of coordination and reaction time.

Conditioning

Conditioning and physical fitness as related to diving mean strength, flexibility and good health to accomplish the gymnastics of diving, whether from a one-meter board or a ten-meter platform, without injury. The activity itself is a good conditioner. As a diver takes longer workouts and his dives become more difficult, he becomes stronger and more fit.

There are those who are taught too quickly, who perhaps have great facility in the mechanics of movement but not matching body strength. These individuals may need particular strengthening exercises. Some may have inherent weaknesses which need attention, principally back, abdominal, leg, foot and upper arm areas. Lack of flexibility is a problem sometimes: ankles, hamstrings, back and shoulders.

More advanced divers use conditioning exercises for speeding up the ability to accomplish difficult maneuvers, and to enable them to withstand the rigors of long, concentrated periods of diving. The use of spotting belts and trampolines is both a quick learning procedure and a safe conditioning practice.

An important factor in accidents is fatigue, and it usually most often affects the advanced diver. He is the one who is highly motivated to go beyond the limits of his strength and endurance. Diving is a skill of precision and coordination more than one of extreme physical

strength. Failure in judgment and timing due to fatigue can result in a serious accident for the highly skilled performer. The last dive of the workout, the "one too many," is often the one which brings out the first aid. Prevention lies in a combination of astute keen perception on the part of the coach, and recognition of the signs in himself by the diver (and his willingness to then stop and rest or stop for the day). "Buckling," or collapsing of the knees on take-off, is a very common sign of trouble ahead. Other signs might be difficulty in holding tensions in positions or at point of entry; muscle twitching, usually in the leg muscles; indecision or frequent balking; emotional reaction to criticism.

In summary, springboard diving is a relatively safe activity if one participates in adequate surroundings utilizing well-constructed equipment which is adequately maintained and uses good common sense in adhering to accepted safety practices.

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Chapter 6

TOWER DIVING

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The safety of tower diving can be analyzed from three aspects, the tower facility, the body conditioning necessary for a diver to work on the tower, and the techniques necessary for diving. Each of these areas will be discussed separately in this chapter.

The Tower Facility

Platform, or tower diving, requires a take-off area, which is ten meters above the surface of the water, at least 20 feet long and 6 feet 6 inches wide, and projects a minimum of 6 feet beyond the edge of the pool. The water under the plummet shall be a minimum of 15 feet deep for a distance of 15 feet beyond the plummet. (6) Lead-up practice, and some age group competition require platforms at intermediate heights of five, and seven and one half meters. While these platforms may vary in size, it is best if they approach the same minimum dimensions as the ten-meter platform. Towers are generally made of either wood or concrete and have, "a covering of cocoa matting or other nonslip material" . . . (1). This matting should run the entire length of the runway and be fitted over the front edge of the platform. This cocoa matting should be replaced periodically when it does not provide the resistance to slipping for which it is designed.

Ladders that lead to the platform should have non-slip surfaces and hand railings on both sides. The platform should have a double railing surrounding the three sides, and these railings should extend to the front edge of the area.

Appropriate markings on the tower, and in the area should include the water depth, the height of each platform, who may use the tower and that each person participates at his own risk. When the platforms are arranged so that one is above the other appropriately placed signs should indicate which ones are open for use and which are closed.

It is imperative that water surface agitators be used while tower diving so that divers will be able to identify the surface of the water and be prepared for the entry.

Body Conditioning

Before beginning a tower program, the diver should undergo an intense physical conditioning program to reduce as much as possible the chances of an injury arising from the impact with the water. At speeds approaching 50 miles per hour upon impact, the body must be held totally firm through the neck, shoulders and lower back to avoid the stress associated with the rapid deceleration. The following are some upper body and lower back exercises designed to strengthen the body for tower diving. (5: 81-99)

Exercise	Body Part Stressed	Muscles Used
1. Military Press (Standing Press)	Shoulder Upper Arm	Deltoid, Triceps, Upper Pectoralis
2. Bench Press (Supine Press)	Arm Upper Chest	Pectoralis, Triceps Anterior Deltoid
3. Arm Extensions	Shoulder	Trapezius, Rhomboids Posterior Deltoid
4. Bent-over Rowing	Shoulder	Posterior Deltoid Trapezius
5. Posterior Military Press (Standing Press)	Shoulder	Deltoid, Triceps
6. Neck Bridge	Neck	Sacrospinalis, Deep Cervical Muscles, Trapezius
7. Neck Curl	Neck	Prevertebral Muscles Sternocleidomastoid
8. Neck Lateral Lift	Neck	Sacrospinalis, Deep Cervical Muscles, Trapezius, Sternocleidomastoid
9. Neck Extension	Neck	Sacrospinalis, Deep Cervical Muscles, Trapezius
10. Shoulder Shrug	Shoulder	Trapezius
11. Sit Ups	Abdomen	Upper and Lower Parts of Abdominals
12. Back Hyperextensions	Back	Gluteus, Hamstrings, Erector Spinae, Deep Posterior Muscles of the Trunk.

There are many new exercise machines available on the market today that enable the diver and coach to isolate muscle groups very effectively. When available, they can be a definite aid in the preparation for tower diving.

Tower Techniques

Correct tower diving techniques vary dramatically from coach to coach and among the geographical areas throughout the country. Certain factors, however, are essential. This section was not designed to provide coaching techniques, but rather to set forth safety principles which should be built into training programs.

Distance. To avoid any possibility of injury, all dives must be executed at a safe distance from the tower. While the normal parabolic path of the center of gravity for a diver from a springboard will allow time to move away from the board; the lack of elevation above the platform in tower diving requires that a greater angle of take-off be used for tower diving because the diver moves past the tower much sooner than the springboard diver returns to the height of the board. While different dives will require different angles of take-off, every dive from a tower will require more 'lean' or more push away from the tower than is required when using a springboard.

Entries. The speed of the body upon impact requires that all tower divers stretch (extend) fully for all entries. Arms "locked out" at the elbows, and overhead, with the fingers interlaced is an essential position that must be mastered at lower levels before diving from 10-meter platforms.

Lead-Ups. Ten-meter dives should be attempted only after consistent lead-ups from intermediate heights have been mastered. (Example: For a back 2½ somersault from 10 meters, a

reasonable lead-up progress would be: a) consistent back 2½ from 3-meter springboard with visual spot; b) back double somersault from 5-meter platform; c) back 2½ somersault from 7½-meter platform; d) back 2½ somersault from 10-meter platform).

Workouts. While type, duration, and intensity of tower workouts will vary considerably according to the time of year, experience and strength of the diver, and type of dives practiced, some common safety practices should be maintained. a) Muscle fatigue will limit the length of the workout. When the diver can no longer hold entries due to fatigue the workout should terminate; b) Number of repetitions should be limited so that all dives planned for that day can be done before fatigue sets in; c) Light workouts may be done each day, however heavy workouts should be held no oftener than every other day to allow the muscles time to recover. It is said, "Fatigue is a protective mechanism by which normal muscle tissue cannot become damaged through excessive accumulation of waste products . . . " (5:56). In other words, fatigue is an early warning alarm that indicates workouts be terminated before injuries occur.

The reader is reminded this chapter is only concerned with the safety aspects, and does not intend to cover tower or springboard techniques.

The Bubble Machine. At this writing the bubble machine is a new innovation for the safety training of springboard and tower diving. Injuries can be reduced by injecting large amounts of air into the water directly under the point of entry, thereby reducing the density of the water and slowing down the rate of deceleration of the body. This, in effect, "softens" the impact. As this machine gains more acceptance and use, it should significantly reduce the number of injuries sustained while learning tower dives.

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Chapter 7

WATER POLO

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Water polo has evolved from a relatively rough, bullish game of 20 to 30 years ago to the rather highly skilled, fast moving sport it is today. The old style game which permitted players not only to take the ball underwater but also each other is now past. Years ago, broken noses, cut and blackened eyes, and facial and body scratches were common. They were the days of three forwards, three guards, and a goalie restricted by the four-meter line. In today's sport the team possessing the ball must play as though it has six forwards while the team on defense must react with six guards. The goalie can come out as far as midcourt. All players must be able to shoot and score as well as guard the opposition.

There are hazards in modern water polo but possibly not as many as in the original game. Proper conditioning and self-defense skills are significant controls in minimizing accidents. Hazards are always present no matter how much time and effort are directed toward their elimination. It is up to the players, coaches, and officials to make sure that no new, unnecessary dangers are introduced into the game.

On the premise that a moving target is hardest to hit, proper conditioning must be the prime deterrent to water polo accidents. Well-conditioned, highly skilled players who have found themselves fatigued and completely ineffective after 15 minutes of scrimmage probably did not know how to pace themselves in a game situation or became frustrated at constantly losing the ball to a less skillful swimmer. Problems that are common to players are a lack of leg power and inability to swim in short spurts with constantly changing direction. To improve these skills, players can use a variety of water polo drills.

In today's sport it is illegal to take the ball underwater in an effort to deceive the opposition. When a player approaches the ball, he must play it and not some part of the opponent's body.

Probably the most important deterrents to accidents are the player's emotional stability and self-discipline. One of the hardest things for the beginner to learn is that he will be fouled often. Because of water polo's unique lack of multiple referees and umpires, many fouls are undetected. It is impossible on a basketball court for officials to notice all rule infractions; in water polo, with more players and the water medium, even two referees can miss underwater action.

Types of accidents

The following are accidents that have actually occurred in water polo and suggestions for minimizing them.

1. The white of a player's eye was cut by an opponent's fingernail while playing the ball. This occurrence caused the player to be out of competition for four months, and it was a year

before the injury healed completely. Short fingernails could have minimized the danger. It is the referee's responsibility to check for rings, jewelry, and long fingernails and toenails that might endanger players.

2. A player's nose was broken from a closed fist blow by an opponent during a tournament. The experienced player who was hurt had entered the tournament insufficiently conditioned. Rather than chase his opponent up and down the pool, he constantly held onto the player. This annoyed and frustrated his opponent, who consequently lost his self-control and punched his opponent in the face when the referees were not looking. Neither player was right. Had the injured player been in good physical condition he would have chased the opponent, as he was the faster swimmer. The player who caused the injury should not have lost control of his emotions. Because of the poor orientation of the pool, the sun shone on the water, which made it virtually impossible for the referee to follow and control the whole game. Therefore, one can also fault poor lighting as well as the tournament officials and the referees who are responsible for making sure that the game is under control and played according to the rules.

3. In another incident, a player was kicked in the groin, a blow severe enough to render him almost unconscious. The kick was probably due to the constant harassment between the two players in an attempt to unnerve each other. The player inflicting the blow either lost his self-control or felt that his opponent "had it coming" for reasons known only to himself. On the other hand, the injured player's lack of self-defense such as keeping his hips high while guarding, made him vulnerable to the blow.

4. Certain incidents are solely accidental. For example, when two teammates broke for the same opening while swimming on different but converging courses, one was struck in the eye by the other's thumb. Severe conjunctivitis and a black eye resulted.

5. In another game, a player who previously had had plastic surgery on his cheekbone was accidentally struck in the face. It was a glancing blow that probably would have been unnoticed had it happened to anyone else. Fortunately, no permanent damage was done, but the injured player was unable to participate further in the game.

6. Another incident involving a blow to the face and nose resulted in the injured player being removed from the game and missing the remainder of the tournament. Lack of conditioning was probably the cause. When interviewed, the player remarked that he "never saw it coming." However, his team had been practicing only twice weekly for a month prior to playing in the tournament.

7. A common injury in early practice sessions is a jammed thumb. This seems to be the result of scrimmaging early in the season before good ball control and ball handling are established.

8. Another early season injury is a strained throwing arm, which is occasionally accompanied by a sore elbow. This is caused by throwing too often in the early season and throwing too hard prior to a warm-up.

9. An accident common to the novice is being kicked in the mouth by the heel of an opponent while chasing him down the pool. A player must be taught to pursue to the side and keep his arms beneath him with elbows bent to prevent the pursued player's feet from driving into his face and abdomen.

10. An accident that was the direct result of one player, a guard, harassing his opponent, a forward, happened in the following manner: the guard constantly pressured the forward throughout the game by pushing, holding, and leaning on him. Annoyed, the forward was determined to "get even." He waited until the action and the referees were at the far end of the pool. He then swung a backhanded closed fist at the guard. However, at the time of the swing and resulting blow, the guard had turned his back on the forward in order to communicate with his goalie. The blow landed on the back of the guard's head, breaking several bones in the forward's hand. The forward was disabled for the season.

11. A common injury to the novice goalie is to be struck in the face by a shot from a teammate

in practice causing nose or other facial injuries. Special attention must be given to the development of goalies during practice sessions.

Most injuries result from one or more of the following causes: (a) playing at less than full speed against less skillful opponents; (b) lack of physical conditioning; (c) occasional overaggressiveness on the part of some players; (d) aggravating an opponent to the point where he loses self-control; (e) improper playing techniques because of lack of experience; and (f) practicing too hard in the early part of the season.

There are no absolute methods of reducing injuries in water polo. Suggestions such as elevated walkways for officials and use of underwater windows for observation of underwater fouls are viable but, at this time, not practical in most facilities. Highly trained officials, experienced in the sport, offer the most reasonable method of preventing injuries as they are better able to understand and discern the intricate tactics used by players. Continued research in developing safety devices such as a lightweight mask for goalies and a mouthpiece for field players is another possible way to reduce injuries. Coaches are responsible for teaching their players the proper skills, techniques and fundamentals of water polo while also teaching the rules of the game which provide for the safety of the individual during practices or in game situations. Coaches cannot permit the pressure to win to minimize the importance of safety in the sport of water polo, if there is to be a continuation of the dramatic growth water polo has demonstrated in the 1970's. Practices, scrimmages or games should never be held without caps and earguards.

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Chapter 8

SMALL CRAFT SAFETY

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There has been a continued growth of recreational boating in the United States since World War II. Today an estimated 8.4 million recreational boats are in use in this country. Approximately one in every seven households owns some type of small craft (recreational boat). One out of every four Americans go boating each year, making it one of America's leading family recreational activities. Quite frequently boating also involves another activity such as fishing (73.8% of the boaters do so for fishing). Just plain cruising, enjoying the sun, the wind, and the smell of the air are the primary activities of 63% of the boating public.

The American public is utilizing the water for recreation in ever increasing numbers. The recreational craft range from inflatable rafts for one person up through 12-meter yachts with sophisticated equipment and highly trained crews.

Modern industrial techniques, the use of new synthetic materials and media exposure to the "good life" have all combined to increase the public's desire for boating and its economic practicality. Also, the U.S. Corps of Engineers and other agencies have built and opened many new water areas to the boating public. It is no longer strange to see boats on the rivers and lakes of the land-locked states of Kansas, Arkansas, and Idaho. Thus, today every geographical area in the U.S. is within easy access of recreational boating areas. In addition, the portability of many new designs of boats has greatly increased the convenience and range of the recreational boater.

It is expected that recreational boating will continue its trend of growth in the coming decades with promotion by competitive corporations and industries and energetic development of outdoor recreational facilities and programs by all levels of government. This increase in boating participation means that there is an increasing responsibility on the part of the boating public and recreational agencies to become more aware of boating regulations, equipment, safe practices and emergency procedures.

There is no one type of craft which would be ideal for all types of boating situations nor could a single design meet the requirements of all possible activities and pocketbooks. Thus, thousands of designs of small craft are available on the market today. These can be classified in one of the five major classes of small craft; inflatable, rowboat, canoe, sailboat or power boat. Each of these five major types of craft require some specialized skill, knowledge and training for safe and competent operation which is peculiar to that classification. Also, the type of equipment necessary for a safe outing will vary among the types of craft and in accordance with the nature of the outing.

Typically, the small outboard boat has led in boating fatalities having been involved in over one-half of the annual total. This is not surprising since these craft constitute about one-half of all recreational boats in use. When the fatality rates were based on passenger-hours, the canoe headed the list with 1.7 fatalities per million passenger-hours while the average rate was about

.5 for all types of recreational boats. Close behind were the rowboat/jonboats with 1.4 fatalities. At the bottom of the list were the houseboats and inboard/outboards with about .1 fatality per million passenger-hours. Clearly, the fatalities are more closely related to how easily the craft is capsized or swamped rather than the means of propulsion. The light, highly maneuverable crafts account for the high fatality rates, not necessarily the motorized craft. Still, the motorized boats (two-thirds of all recreational craft) contribute to three-quarters of the fatalities, (nearly 1,200 to 1973) a slightly disproportionate share of the total.

These same statistics reveal that experienced boaters are quite likely to be involved in a boating accident. Thus, even the experienced, but untrained, boater can use supervised instruction and training in order to increase his ability to handle routine and emergency situations with greater skill and confidence.

SAFETY FACTORS

Of the millions of people involved in recreational boating each year, only a fraction are fully aware of the variety and complexity of factors which affect their safety on each outing. This fact is shown in the Coast Guard statistics that over 50 percent of the 1,446 fatalities in 1974 were attributed to "fault of operator." Each year the Coast Guard compiles and publishes *Boating Statistics* (CG 357), an annual report of recreational boating accidents. Today, any accident which involves loss of life, $100 or more in property damage, medical treatment, incapacitation for 24 or more hours, or loss of consciousness is a reportable accident.

It is necessary that the operator of a boat be able to make decisions and perform skills in addition to exercising good judgment. In boating the quality of equipment is important, as well. In any type of small craft activity the occupants must be able to handle themselves in the water as 90 percent of all recreational boating fatalities in 1974 were the result of drowning. Also, over $9 million in property damage resulted in 1974 from boating accidents. It should be noted that in many respects the Coast Guard statistics are incomplete or inaccurate due to missing data. Over 20 percent of the fatalities were listed as "unknown cause."

In reality there are multiple causes in most boating fatalities, as in nearly every case, accidents are the result of a series of events. An overboard fatality may result from sitting on the gunwale of a motorboat during a high speed turn by a person who does not know how to swim and is not wearing a lifejacket (Personal Flotation Device — PFD). Each factor contributes in its own way to the resulting fatality which could usually have been prevented at any point in the series of events. Generally, there are four basic categories of factors which contribute to the safety of a recreational boater: a) operator skill and judgment, b) sound and serviceable equipment, c) environmental conditions, and d) rescue and self-rescue skills. Each of these factors must be of primary concern to the boating public in order to reduce the incidence of small craft accidents and fatalities. There should be a greater sense of pride and achievement, as well as confidence, in doing something well which should also make the activity much more rewarding.

Operator Skill and Judgment

Included in the classification, "fault of operator," are such things as: improper loading, improper installation and maintenance, overloading, carelessness, weather conditions, and lack of experience. In addition to operator negligence such things as: hazardous waters, adverse weather conditions, excessive drinking, and the other person are listed as prime causes of fatalities which may have been prevented by safety training and experience. There is no substitute for operator skill and experience to ensure a safe outing. A boat operator needs to know the handling characteristics of his craft along with his and its limits of safety under varying conditions. Handling an empty craft in calm waters on a calm day is entirely different from handling a fully loaded craft with water in the bilges on a choppy sea with a strong wind blowing.

It is the operator who must, in the final analysis, determine what he and his craft are capable of doing and under what circumstances. Basic training in boat handling and safety is offered by such organizations as the United States Power Squadron, Coast Guard Auxiliary, Red Cross, camps, scouts, YMCA, schools, clubs and state agencies. There may be other groups which offer more or less formalized and competent training in small craft safety. According to a Coast Guard study about 25 percent of the boating public have taken some type of boating safety course. Most of these courses of instruction are classroom oriented in boating theory, rather than practical skills courses taught on the water. There is little doubt that practical, on the water, training in conjunction with classroom theory is a far more effective means of developing safe boating habits than is an approach that includes only theory. Although it is not always practical to obtain on the water instruction and training, it should be obtained whenever possible.

Small Craft Equipment

A primary concern for the safety of any type of small craft is its buoyancy when swamped, capsized or holed. The craft should have flotation chambers built in and filled with expanded foam in such quantity and location to support the boat, occupants, and equipment at the surface in a horizontal and upright position. Inflatable boats should be constructed with at least two separate chambers such that if one were to be punctured, the other one would still keep the craft, equipment, and occupants on the surface. Kayaks and decked canoes should be buoyant when swamped; the more buoyancy, the better.

Another matter of general concern for small craft safety is the presence and use of PFD's (lifejackets). It is required by law that there should be at least one USCG approved PFD on board and readily accessible for each passenger. In decked canoes and kayaks, the PFD must be worn. Larger types of craft must also carry a USCG approved throwable PFD. Under any type of adverse (other than optimal) conditions, such as rough weather or rapids, all persons should wear their PFD. All nonswimmers or weak swimmers should wear their PFD at all times when on the water.

Any type of craft should have an alternate means of propulsion. Canoes or rafts should have spare paddles, sailboats should carry oars or a paddle, rowboats should carry a spare oar, motorboats should have oars or a paddle, etc. No matter what the intended means of propulsion, there should be an effective back-up means of propelling a boat. All too often a motorboat runs out of fuel and then the operator discovers that the paddle is too short to even reach the water, much less propel the craft, especially in a wind.

Most boats in use today have a capacity plate which lists a maximum safe horsepower and maximum safe load in persons and pounds. These are to be considered maximum under optimal conditions for safety, assuming proper distribution of weight and boat trim. Both weight and power ratings should be reduced under any adverse environmental condition. The rule of thumb is, if the craft has no capacity plate, have only one-third of the boat in the water. In other words, if you have a jonboat which measures 12 inches from keel to lowest point along the gunwale or transom, then it should not carry any weight which would reduce its freeboard to less than eight inches. If the boat were 14 feet long and 5 feet abeam, this would permit a total weight of about 1,400 pounds, including the boat, equipment and passengers.

Following is a suggested list of equipment which might be carried on board each of the five major types of small craft:

1. Inflatables: PFD's, paddle or oars, bailer, line
2. Rowboats: PFD's oars, spare oar or paddle, bailer, anchor and line
3. Canoes or kayaks: PFD's, paddles and spare, bailer, painter (line), knee pads
4. Sailboats: PFD's, paddle or oars, anchor and line, bailer, tools
5. Power craft: PFD's, motor, gas, fire extinguisher, whistle or bell, flame arrestor, ventilation, anchor and line, bailer, oars or paddle, tools, spare parts, first aid kit, charts, lights, and radio

The recommended and required equipment may vary considerably depending on the size as well as, the type of craft and the area of operation, especially the requirements for lighting at night and equipment on power craft. Coast Guard and state regulations must be checked and followed in all cases. A good rule of thumb is to come prepared for the worst and hope for the best.

Environmental Conditions

The primary environmental considerations for the small craft operator are the weather and the water. An experienced boatman keeps a constant alert for up-to-date and reliable weather forecasts prior to his outing. Long range predictions are available in the daily newspapers, but the best up-to-the-minute reports are obtained from TV or radio and should be checked as soon as possible before and during the outing. Also, once underway, the operator is alert for any changes in temperature, wind, clouds and barometric pressure which may indicate the approach of bad weather. Of greatest concern to the boater are: wind velocity, lightning, visibility, and water conditions.

Wind velocity. Increased wind velocity with resulting large waves in open water can greatly affect the handling of a small craft. Even sailors who love the wind will not venture out when it is too strong. Some sailors will begin to panic when the wind approaches 15 to 20 mph, while others find this wind to be ideal for exciting and fun sailing. In any case, when the winds are such that you cannot enjoy the outing, or handle the craft with confidence and precision, it is time to be ashore, not afloat. It is important to recognize the fact that people with varied boating skills can handle the boat safely in many different kinds of adverse weather conditions. What is unsafe for one person to attempt, may still be well within the limits of another's capabilities. There is nothing more important than knowing what your capabilities are, and to stay within them while gradually expanding your skills.

Visibility. With the increased popularity and accuracy of electronic aids to navigation, low visibility has become less of a concern to many boaters. However, smaller craft or boats without such aids should not venture out in a fog, haze or other conditions that would reduce visibility to an extent which might result in disorientation of the operator. The possibilities of running aground, collision, and simply getting lost are usually too great to risk.

Lightning. Thunderstorms represent the single greatest weather threat to small craft. A thunderstorm will not only produce high winds with waves, but will also reduce visibility. The most dangerous element of all is the accompanying lightning. Add to this the fact that in many boating areas a thunderstorm is likely to come up with very little warning, and it is possible to visualize its potential danger. It is best to be wary when thunderstorm activity is predicted in an area, and all craft should not venture far from shelter. Radios can be useful in detecting storms in the areas as they will emit static noises due to the electrical discharges of lightning. Fortunately, thunderstorms are of relatively short duration. If you are caught unaware in the path of a thunderstorm, keep all weight low in the craft, bilges dry, and reduce leeway with an anchor or drogue. It is best to seek shelter at first warning of a thunderstorm. Remember that lightning tends to strike the highest object in an area, so keep everything low and get off the water. Sailboats with their tall masts pose a particular problem in thunderstorms and therefore operators of these boats should be especially wary.

Water conditions. The type of water may pose special problems for the recreational boater. An outing on a small lake might mean that you would elect to leave behind some of the safety equipment. Such equipment would ordinarily be taken along on larger waters where you would probably venture further from shelter and assistance. The boat operator should be aware of the location of shallow waters that are to be avoided, and of the currents or tides in the area of operation. Large waves are possible on large bodies of water even on calm days and need to be taken into account.

The fatalities on rivers are increasing dramatically. White water and river trips are becoming very popular and call for high skill and specialized knowledge and techniques. Rivers are being run by canoes, kayaks and rafts in ever-increasing numbers. Any outing on fast water should be in conjunction with either a commercial outfitter or a river boating club and the trip should include experienced leaders. A majority of river fatalities are the result of private rafts (referred to by river guides as "suicide or kamakazi rafts") with its occupants not wearing any type of PFD.

All participants in a river outing *must* wear a PFD. Do not venture into an unknown area without first obtaining reliable information about that area. In summary: a) be aware of potential hazardous areas, b) be familiar with the area, and c) know where there is shelter and possible assistance.

Rescue and Self-rescue Skills

The fact that nearly 90 percent of all boating fatalities result from drowning emphasizes the importance of swimming skills. An unexpected fall overboard or capsizing of the boat may cause panic even among skilled swimmers. An occupant of any small craft should be able to handle himself in the water as a minimum prerequisite for small craft participation. A person who has a basic fear of water is a potential hazard to himself and to others in a small craft situation. In small craft activities it is a good idea to be prepared to be *in* the water, not just *on* the water. It is also true that some types of craft are more likely to capsize and place its occupants in the water than are some other types of craft. A canoe is a prime example. It is a very versatile and maneuverable craft when properly handled, but can pitch its occupants into the water with very little provocation.

Beyond being "at home in the water," small craft participants should be able to sustain themselves at the surface for five minutes as a minimal swimming skill. Any period of time less than this and they must be considered weak swimmers who should wear PFD's while in small craft. The Red Cross has a five-minute swim test as a prerequisite for enrollment in their small craft safety courses and consider this only a minimal swimming requirement.

An individual's ability to sustain himself in the water depends upon: his swimming skill, his physical condition, clothing, and temperature of the water. A person wearing only a swim suit who falls overboard on a summer day into 75°F (24°C) water is confronted with a different situation than a hunter dressed for cold weather pitched into 45°F (7°C) water, and this is different than a paddler in white water who ends up swimming through difficult rapids of spring snow melt. In any case, the basic aquatic survival techniques that are taught by such agencies as the YMCA, and Red Cross chapters in most communities, as well as by other agencies should be mastered. Such skills are demanded as a routine part of the activity and must be developed.

In the case of a boat that has capsized or swamped, it is generally best to stay with the boat. Most craft will float even when completely filled with water because boat manufacturers are required to build adequate flotation into the craft. In such a case the boat is a better lifesaving device than anything else, also the boat is more easily spotted by potential rescuers than a swimmer. If possible, the boat should be turned upright and re-entered with caution so the boat will not turn over again. Under some circumstances, leaving the craft may be necessary as in the case of possible explosion, sinking, fire, drifting into a dangerous area, or in cold water. In all instances where a boater is in the water, he should use a lifesaving device or PFD. In one-third of the reported rescue situations there was no assistance from another party. Yet in nearly 50 percent of the cases, assistance came from a nearby boater. Clearly, the boating public should be able to assist others in need, and also be able to handle their own problems without outside aid.

SUPERVISION OF SMALL CRAFT ACTIVITIES

An increasing number of agencies are utilizing small craft activities as an overall part of their program, be it recreation, education or some related program. Such activities may range from a simple outing of one or two hours in a rowboat to an extended cruise via motorsailer or canoe. In such an organized setting the leader assumes a certain amount of responsibility for the participants' safety afloat. The extent of responsibility depends upon the involvement of the participants: will they be merely passengers with no concern for the operation of the craft, or will they be expected to operate the craft during the outing?

Participants as Passengers

The responsibility assumed by the leader and organizing agency is somewhat less when the participants are only passengers aboard the boat rather than operators of the craft. Still, a certain number of precautions should be taken. The swimming ability of the individuals should be determined. Those who are nonswimmers or weak swimmers, should either be left ashore or required to wear a PFD while afloat, depending upon the likelihood of being in the water during the activity. The participants should be informed of the basic procedures for their safety as they relate to that specific activity and craft. The boat operator must be trained and experienced in the operation of the craft.

Participants as Small Craft Operators

The Department of Health, Education and Welfare recognizes the need for trained specialists in charge of all watercraft activities. Although these guidelines were developed specifically for camps, all agencies would do well to meet these recommended standards for supervision of specialized activities:

1. Supervision of Specialized Activities
   When campers participate in specialized or high risk activities such as, but not limited to, *horseback riding, hiking, scuba diving, rock climbing, firearms, canoeing,* and *aquatic events,* the counselors supervising the activity shall possess evidence of appropriate training and experience in their program specialties. When applicable, adequate provisions shall be made to assure any special training necessary for camp personnel to protect the safety and health of handicapped campers.
2. All *watercraft* activities shall be supervised by a minimum of one counselor on the water to each 12 campers in watercraft except when participating in salt water or white water activity at which time a minimum of two counselors must be on the water in separate watercraft regardless of the number of campers. Said counselors shall possess at least an American National Red Cross Advanced Lifesaving Certificate or its equivalent and shall meet at least one of the following criteria:
   A. Have participated in three white water canoe or raft trips totaling at least 6 hours on the water.
   B. Have had at least 6 hours of practical instruction in survival and stream safety as taught by the American National Red Cross or its equivalent (there is no existing Red Cross training in this context at this time).
   C. One counselor must hold a current American National Red Cross Small Craft Instructor Rating or its equivalent for the intended craft used.
3. Campers shall possess at least an American National Red Cross Advanced Beginner Swimming Certificate, American National Red Cross Survival Swimming Certificate, or its equivalent before being allowed to participate in either white water or salt water boating activities. All white water activities must be carried out on water determined to be no more difficult than Class III as defined by the International Scale of River Difficulty. No trips shall be taken on unclassified white water. (DHEW, 1975)

It should be noted that these standards apply to open water or white water activities when the participants will be the boat operators. Ideally, they should be or should have been instructed by the leader in how to handle the craft safely in that situation, in addition to having a trained and experienced individual in charge so that he may make intelligent decisions involving good judgment for the safety of the group.

The sponsoring agency also is responsible for the serviceable condition and presence of all craft and equipment appropriate for the activity. Both the craft and equipment should be periodically inspected for abnormal wear and to be certain it is operative. Any equipment which is not completely serviceable should be repaired or replaced.

In summary, it is essential that: a) all equipment be in good repair, b) all participants demonstrate basic swimming and survival skills, c) a Red Cross certified Small Craft Safety Instructor or equivalent for the specific type of craft be in charge of the activity (It is the responsibility of this trained specialist to make all decisions affecting the safety and well-being of the group while engaged in the activity), and d) the participants have acquired the necessary skills for safe participation in that particular activity.

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Chapter 9

WATER SKIING

Roland James George
Revised by Thomas C. Hardman
Winter Haven, Florida

Water skiing is one of the simplest outdoor sports. This is evidenced by the many successful beginners who have never before participated in athletics. Water skiing can be as easy and as much fun as it looks. As in bicycle riding, getting started is the most difficult step. Water skiing is basically safe; the degree of safety depends upon the common sense precautions taken by both the skier and the towboat driver who has the major responsibility for the skier's safety.

Accidents

Annual surveys of the Outboard Boating Club of America and the American Water Ski Association show conclusively that even though an estimated 12,000,000 persons enjoy water skiing annually in the United States, accidents and fatalities are infrequent. While water skiing has become the primary incentive for people to buy outboard boats and motors, serious or fatal accidents on skis represent a small percentage of boating accidents.

The vast majority of accidents in water skiing involves either the amateur or the reckless participant. This includes the untrained boat driver, the novice skier, and the poor swimmer. Accidents also occur when the activity is unsupervised. Most intensive skiing is done in organized ski clubs, commercial ski schools, ski shows, and competitive tournaments. The incidence of accidents in these organized segments of the sport is extremely low. During the more than 35 years that the American Water Ski Association has been sponsoring water ski tournaments, there has never been a fatality in any of its sanctioned events. Many commercial ski schools have operated for 15 to 20 years without a serious accident or fatality. This record has been maintained in areas where skiing goes on steadily for as many as 8 to 10 hours daily.

Basically, there are five elements of safety consciousness in water skiing: (a) the skier, (b) the skiing gear, (c) the boat driver, (d) the boat and motor, and (e) the water.

Hazards Caused by the Skier

Water skiing accidents are invariably caused by errors either on the part of the skier or the boat driver. There are the problems of not wearing a life belt or jacket, not having an observer in the towboat, not knowing the skier-driver signals, or not releasing the towline after falling. Falling may be fun for the adventurous student, but the time it takes to pick him up cuts down on instruction time. Falls are rarely dangerous and are more frequently caused by unexpected rough water or by the misjudgment of the instructor or boat driver than by the skier. In falling, a skier is less likely to be injured from hitting the water than from hitting docks, piers, pilings, sea walls, and boats. In salt water areas, oyster bars, barnacle encrusted walls, and pilings can cause serious injuries. Skiing in shallow water is hazardous because the skis hit bottom and

throw the skier forward, resulting in sand and grass burns, rock scratches, or fractures. The minimum depth for safe skiing is four feet for children and five feet for adults.

Skiing at night is unwise and most states forbid it. Exceptions to night skiing include ski shows or exhibitions, and other organized water activities with adequate lighting.

It is unsafe for two people to ski together with ropes of different lengths. If the skier on the long rope falls, the rope can easily wrap around and entangle the skier on the short towline. It is difficult to avoid the dragging and whipping rope or the spray thrown by the handle dragging in the water. Another hazard is fatigue; a tired skier not only ceases to learn, but becomes a hazard to himself and others. In landing, a skier should run parallel to the shore rather than straight into it. Before skiing, one should check the steering cables, tow ropes for worn and frayed spots, loose runners, wing nuts, binder slivers, and any sharp protruding objects on the skis.

Hazards Caused by the Boat Driver

A common hazard caused by boat drivers is "hitting it" before the towrope is taut, before the skier's tips are visible, and before the skier has indicated readiness. The driver should steer away from objects, such as piers, docks, pilings, sea walls, and other boats. Additional hazards caused by the driver include not cutting the speed of the boat and following another boat too closely — 200 feet is a safe distance. Accidents are also caused when: (a) the driver or observer rides on the gunwale or on the back of the seat, (b) when any passenger jumps from a moving boat, or (c) when a downed skier boards an outboard or stern drive boat from the stern.

Removal of Hazards

When the skier falls, the observer should give instant notice to the boat driver who, in turn, should reduce speed immediately and determine if the skier is all right. After a skier falls, he should clasp both hands overhead to signal that he is all right or hold up a ski so that other boat drivers can see him. With an OK signal from the skier, the driver should circle toward the skier at a reduced speed. This will allow time for the skier to put on his skis, the observer to adjust the rope, and the driver to circle accordingly. The driver should approach the skier from the downwind (i.e., leeward) side so that the boat will not drift over the skier. The motor should always be in neutral when passing near the skier. However, an idling motor is not always safe since the propeller may still be turning and thus cut the skier. After the fallen skier has grasped the rope and handle, the driver should continue forward at idling speed until the towline is taut. The driver should then check the lake traffic and proceed when the skier gives him the "hit it" signal.

If for any reason a skier has not been brought in for a landing parallel to the shoreline and is in danger of hitting a dock or piling, or even the beach at too great a speed, the skier should sit down on his skis and drag his hands in the water. An emergency procedure would be to fall backward forcing the skis upward into the air. A skier still has control of his skis after the handle is released, and he should change his direction or "brake" to a stop as his situation dictates.

Conditioning

Skiers should develop their muscles with barbell and isometric exercises. Quarter squats and thigh extensions will strengthen the knee extensor muscles to the fullest extent. "Sitting pulley rows" and the "two-hand barbell curl" are used mainly for increasing bicep strength and building power in the upper arms. Sit-ups will build abdominal strength. Other exercises will help to strengthen the wrists, arms, and back.

Facilities and Equipment

Although boats of less than 16 feet and powered by outboards of 50 horsepower or less are capable of towing skiers, a more versatile ski boat should be 17 to 19 feet long with over 100 horsepower. A wide beam is essential in a good ski boat to provide stability against the pull of the skier cutting sharply to either side of the boat. A wide range of ski boats is available with inboard, outboard and stern drive power. Outboard engines now range up to 200 horsepower, so that single engine applications, both inboard and outboard, are adequate for even the most demanding skiing. Although most skiing is done at moderate speeds, the hull and power combination should be capable of towing a skier up to 30 to 35 miles an hour. The extra power makes getting up on skis easier for beginners and also enables practice on a single slalom ski at competition speeds.

Boats should be equipped with a minimum of two paddles; small anchor; extra line and motor parts; horn or whistle, speedometer or tachometer (engine revolutions per minute); tool kit; lifesaving equipment; fire extinguisher (if the boat has any enclosed spaces); boarding ladder; rear view mirror; sufficient life jackets and/or cushions for the driver, observer, skier, and any passengers; running lights; steering wheel; first aid kit; extra gas supply; and registration numbers. However, when a boat is used expressly for skiing, all chrome and other fixtures projecting from the sides and top, such as flag standards, lights, and cleats which may snag the rope should be removed. Windshields are optional.

The ski tow hitch should be sturdy and well constructed. It can be a center mounted pylon; a transom mounted hitch, which also carries the rope out of the water for easier visibility; or a rope yoke attached to the tow eyes on the transom of the boat. A rope yoke should be equipped with a free riding swivel to which the towline is attached. The swivel distributes the pull of the skier equally on both sides of the transom and makes driving safer and easier. A safe way to attach a towline is to install eye bolts in the transom of the boat. Life handles on the boat or motor clamps should not be used as substitutes. Electric ski rope retrievers play line out automatically so that if a skier falls, a touch of a button, operated in the boat, retrieves the rope. A hitch should be designed to hold the rope away from the motor. Some hitches hold the rope above the motor to prevent its dipping into the water and becoming fouled in the propeller. Many hitches attach to the transom, while others are installed inside the boat, forward of the motor.

For water skiing, a low freeboard is recommended to provide easy boarding for the skier in the water and reduce weather vaning or wind drift while standing still. High freeboards are designed more for heavy seas and open water where skiing is rarely done. Ski hardware and attachments, such as fins, foot binders, screws, and nuts, should be as simple as possible and free of sharp protruding surfaces that could scrape or cut the skin. Ski lines and handles should likewise be free of complicated hooks and eyes as well as unnecessary loops that might entangle, catch, or cut the skier.

The most popular ski lines are made of quarter-inch braided polypropylene or polyethylene which floats and comes in a wide variety of colors for easy spotting in the water. Any type of ski line may have a tendency to loop when floating free, and extra caution should be exercised to avoid catching a hand or digit in a loop as the towboat is pulling the line taut. Although double handles which formerly were favored for slalom skiing are still available, the most widely used handle is the single bar about 11 to 12 inches long and one to one and one-eighth inches in diameter. Available either in wood or in cushion covered wood or aluminum cores, the handle should be attached to the rope with a V bridle approximately one foot long. The bridle lines should be attached to either end of the handle in such a manner that there is a minimum of movement between the rope and the handle when in use in order to avoid slippage which could result in a pinching action between rope and handle.

Water skis are made of wood, wood laminates or reinforced plastics. With the introduction of such "space age" cores as aluminum honeycomb, the reinforced plastics are rapidly gaining in popularity, particularly among competition skiers. Ski bindings are made of soft rubber or plastics and come in either fixed or adjustable types. Most pairs of skis now on the market come equipped with an extra toe binding on one ski so the skier can make a ready transition from doubles to a single ski. The slalom ski is now the most popular seller among all types of skis. Slaloms come in a range of lengths and with various types of bottom configurations and bevels to appeal to skiers of all sizes and degrees of skill.

The American Water Ski Association has called on water ski manufacturers to avoid making sharp pointed skis and restrict the ski top radius to a minimum of one and one-fourth inches as a safety measure. This action was taken after reports of eye and other facial injuries resulting from falling on skis that had been tapered into sharp points solely for appearance purposes.

Conclusion

Most states have regulations dealing with reckless and negligent behavior in water skiing and boating. Generally, their rules and restrictions are patterned after recommendations of the American Water Ski Association to the National Association of State Boating Law Administrators. These recommendations cover such activities as skiing in the area of fixed objects and other boats, skiing after dark, use of observers and rear view mirrors, wearing of safety devices and multiple skiing. Despite the mushrooming popularity of the sport which now attracts more than 12,000,000 participants in the U.S. alone, there has been no accompanying increase in accident reports to the U.S. Coast Guard or to the American Water Ski Association. This indicates that the boating and skiing safety education programs of these organizations and others like them are paying dividends.

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Chapter 10

SKIN AND SCUBA DIVING

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There are three basic areas associated with the teaching of a scuba student — skin diving (pool); scuba diving (pool); and skin and scuba diving (open water). While these situations have common problems, they are discussed separately in this chapter.

Classes in skin and scuba diving have one inherent danger for associated with underwater activity is the unexpected loss of consciousness followed by physical injury and drowning. The primary safety concern of an instructor involved in teaching an underwater activity is the prevention of such possibilities through class procedures and organization. Secondary concerns involve the common use of scuba equipment, and the maintenance of equipment for classes. Final concerns are the use of safety equipment in class and the availability of the correct equipment for pool and open water classes in order to prevent accidents.

Skin Diving (Pool)

The skin diver is dependent on his ability to hold his breath, and therefore, he is tempted to try to improve his breath-holding ability. Shallow water blackout involves hyperventilation and the following anoxic condition. Precautions should be taken in all skin diving classes and students should be warned against excessive hyperventilation prior to breath-holding activities associated with skin diving.

If mask, fins and snorkel are supplied to the class, care should be taken to use a disinfectant solution following each person's use to prevent any possible spread of infections.

Scuba (Pool)

Medical Problems. Air embolism is the result of a scuba diver failing to exhale during ascent. This is a major concern for the instructor when teaching a course in scuba. Preventive steps must be taken before scuba is practiced in deep water in order to lessen the chances of air embolism. The following is the teaching sequence leading up to deep water ascents.

1. Fully cover the theoretical aspects of air embolism in the classroom or on the pool deck so that the potential danger is understood by all students.
2. Teach and stress the displacement method of snorkel clearing (clearing during ascent).
3. Introduce scuba in shallow water (less than 5 feet). Include skills and situations such as mask flooding and clearing, regulator clearing with scuba, and horizontal and vertical ascents in shallow water before moving to deep water.
4. Practice controlled exhaled ascents when first using scuba in deep water.

Disinfectant solution should be used to cleanse regulator after class use for prevention of spread of infections.

NOTE: Other medical problems (decompression sickness, nitrogen narcosis, etc.) while

essential to the theoretical content of a scuba course, do not directly relate to potential problems of basic scuba classes in a pool setting and are not included here.

Equipment. A major concern to an instructor in basic scuba is the care and maintenance of equipment. The nature of the high pressure cylinders and demand regulators make it essential that proper precautions be observed to insure safe handling of equipment. In the case of regulators, the scheduled yearly maintenance should include replacement of worn rubber parts (diaphragm, high pressure seats) and proper adjustment of intermediate and final pressures so that there is no interruption of proper air flow. Adjustment and repair should be made by qualified service personnel to insure proper functioning at all depths.

The high pressure cylinders or tanks are potentially the most dangerous piece of equipment with which the scuba diver must deal. It is imperative that the following safety precautions be followed without exception:

1. Visual inspection of all cylinders at least once per year.
2. Hydrostatic inspection of all cylinders at least once every five years. Hydrostatic tests may be repeated more often depending on the use of tanks. Recommended maximum interval for tanks that are used frequently would be three years.
3. Tanks stored for any period over seven days should be in a supported vertical position with 300 to 500 pounds of air.

A tank filler station should be constructed in such a way that maximum protection is afforded the operator and any other person in the area. A tank filler station includes a compressor, cascade storage system and filler station.

The compressor should be located in a separate room from the filler station and cascade bottles. It should have outside ventilation and located away from parking lots or driveways to insure fresh pure air. Manufacturer recommendations with respect to filter and oil changes and replacement should be followed precisely. An automatic shutoff switch on the compressor should be set to correspond to the working pressure of the cascade system.

The cascade system is a set of air storage bottles, usually with a fill capacity of 300 cubic feet each. The minimum number of cascade bottles is usually three, with an unlimited maximum number. These storage tanks are subject to the same precautions as scuba cylinders (see page 60) and must be visually and hydrostatically inspected at the same intervals as scuba tanks. Proper equipment for a cascade system includes: tank filler hose, air pressure gauge and vertical supports for the system (chained to the wall).

The filler station is the area in which the tanks are filled. There are many possible arrangements for a filler station. They should be designed, however, to best protect the operator in case of tank failure, leading to explosion. The main components are the filler tank and water supply. Cold running water with automatic overflow drain enables the tank to be filled in the best environmentfor maintenance of constant temperature. The filler tank itself can be made out of metal, plastic, wood or concrete. Whichever type is used, it should fit one of two requirements: 1) a metal station should be strong enough to withstand burst pressure of tanks (3,000 psi minimum) since water transmits the force of explosion, or 2) in the case of non-metal stations the force of explosion through water is reduced and contain the exploding container (example — water in a plastic barrel surrounded by wood or concrete having an air space in-between).

NOTE: Other safety equipment used in class situations will be covered in the section on open water experience.

Teaching Procedures. All scuba experiences should be taught using the buddy system. This enables every person in the class to be under constant observation by at least one other person at all times while learning scuba skills.

All students should become familiar with safety equipment used in scuba diving. Use of buoyancy compensators, sea view gauges, wet suits and emergency reserve systems should be

well-practiced in a pool situation under the guidance of the instructor and in a buddy system setting.

The scuba instructor should be aware of the easiest accessible medical help in the event an emergency should arise during a scuba class. Not only does he need to know the location of medical help, but also the nearest recompression facility.

Course Pre-requisites. Prior to the beginning of the scuba course, each student should meet three requirements. This enables the instructor to have a common base from which to start:

1. Successfully pass a swim test consisting of: (a) a non-stop 300-yard swim (preferably crawl stroke), (b) a 15-minute tread water (3 minutes no hands), and (c) a 45-foot underwater swim without the aid of a push-off.
2. Medical Exam — an example of a medical history and examination form is included on pages 65 and 66.
3. Waiver of liability — Sample forms for individual consent and parental or guardian's release and indemnity agreement are presented on pages 63 and 64 respectively.

Open Water Experience

Students participating in the open water experience at the conclusion of a scuba course should meet the following criteria:

1. Complete medical form (see pages 65 and 66)
2. Complete waiver form (see Forms, pages 63 and 64)
3. Satisfy minimum theoretical requirements through performance on a written exam.
4. Satisfy minimum practical requirements through performance in pool tests.

In addition, all students should be outfitted properly either through equipment supplied in the course, or by individual purchase or rentals. The list of equipment should include:

1. Mask
2. Fins
3. Snorkel
4. Tank(s)
5. Regulator
6. Sea view gauge
7. Buoyancy compensators
8. Wet Suit (if needed)

Procedures for the open water dive will depend on the number of students, number of instructors, equipment and dive site. Basic common procedures include:

1. Small teacher/pupil ratio — one to one for the initial experience
2. Descent line from surface to desired depth (with surface float)
3. Communication signals cleared between divers before descent
4. Adequate visibility (if possible) to establish regulator clearing, buddy breathing, pressure equalization and mask clearing

Accessory Personnel

Open water safety begins with the assignment of a qualified responsible person to assume the role of dive master. Each diving team should be checked *in* and *out* by the dive master for each dive. Post-dive information sheet should include: buddy team; air pressure in/out; time in/out; weight used; and maximum depth achieved; diver performance; and pass/fail.

If possible, a small power boat or rowboat should be on the water to aid divers in distress. This boat tender should include a certified diver able to help a student diver in trouble. Additionally, his job would include looking out for other boats in the area.

A person familiar with the functioning of scuba equipment should be stationed on land to aid in donning, doffing or rectifying any malfunction of equipment. The equipment manager is an essential part of the overall safety team.

Course Records

Complete records for all scuba courses should be maintained. Record keeping, for liability purposes, should include the following:

A. Pre-Course
   1. Medical form (see pages 65 and 66)
   2. Waiver form (see pages 63 and 64)
   3. Swim Test Record

SCUBA RECORD CARD

Name: _____ Section: _____

Student No: _____ Term: _____

1	2	3	4	5	6	7	1	2	3	4	5	6	7	Physical Exam:
8	9	10	11	12	13	14	8	9	10	11	12	13	14	
15	16	17	18	19	20	21	15	16	17	18	19	20	21	Date:
22	23	24	25	25	27	28	22	23	24	25	25	27	28	
29	30	31					29	30	31					Pass _____ Fail _____
1	2	3	4	5	6	7	1	2	3	4	5	6	7	Mask No: _____
8	9	10	11	12	13	14	8	9	10	11	12	13	14	
15	16	17	18	19	20	21	15	16	17	18	19	20	21	Fin No: _____
22	23	24	25	25	27	28	22	23	24	25	25	27	28	No. of Abs: _____
29	30	31					29	30	31					

B. Diving Course (see page)
   1. Attendance (with lesson plans included)
   2. Pool test results
   3. Theoretical test scores
   4. Recommendations for certification

C. Open-Water Dive
   1. Date, Time
   2. Buddy; Air pressure in/out; Time in/out
   3. Weather Condition
   4. Water Condition
   5. Student Performance
      (a) Equalization pass/fail
      (b) Mask Clearing Pass/fail
      (c) Regulator Clearing pass/fail
      (d) Buddy Breathing, etc. pass/fail
   6. General Comments

D. Post-Dive Information
   1. Certification recommended
   2. Certification given (date)

THE PENNSYLVANIA STATE UNIVERSITY
The College of Health, Physical Education and Recreation
PARENTAL OR GUARDIAN'S RELEASE AND INDEMNITY AGREEMENT
(To be completed by minority students only)

The undersigned, being the parent, guardian, or person having the care and custody of (1) _____ does hereby consent that his (3) _____ may take the prescribed course in skin or scuba or participate in the diving activities and instruction of skin and/or scuba diving, and in consideration of (2) _____ of (4) _____, permitting our (3) _____ to so participate, does hereby covenant and agree not to sue (2) _____ of (4) _____, for any claim which may arise out of the aforementioned activity, and does further agree to indemnify and hold harmless the said (2) _____ of (4) _____ from any claim which our (3) _____ (1) _____ may claim from the aforementioned activity.

IN WITNESS WHEREOF, the undersigned has hereunto set his/her hand and seal this _____ day of _____, 19 ___.

_____ _____
Date Signature of Parent or Guardian

_____ _____
Date Signature of Student

Legend:
(1) Full name of the student.
(2) Full name of course instructor.
(3) Son or daughter.
(4) Name of institution or organization sponsoring the course.

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THE PENNSYLVANIA STATE UNIVERSITY
The College of Health, Physical Education and Recreation

WAIVER, RELEASE AND INDEMNITY AGREEMENT

For and in consideration of permitting (1) _____ to enroll in and participate in diving activities and class instruction of skin and/or scuba diving given by (2) _____, in the City of _____, County of _____, and State of _____, beginning on the _____ day of _____, 19 _____, the Undersigned hereby voluntarily releases, discharges, waives and relinquishes any and all actions or causes of action for personal injury, property damage or wrongful death occurring to him/herself arising as a result of engaging or receiving instructions in said activity or any activities incidental thereto wherever or however the same may occur and for whatever period said activities or instructions may continue, and the Undersigned does for him/herself, her/her heirs, executors, administrators and assigns hereby release, waive, discharge and relinquish any action or causes of action, aforesaid, which may hereafter arise for him/herself and for his/her heirs, executors, administrators and assigns prosecute, present any claim for personal injury, property damage or wrongful death against (3) _____ or any of its officers, agents, servants or employees for any of said causes of action, whether the same shall arise by the negligence of any of said persons, or otherwise.

IT IS THE INTENTION OF (1) _____ BY THIS INSTRUMENT, TO EXEMPT AND RELIEVE (2) _____ FROM LIABILITY FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH CAUSED BY NEGLIGENCE.

The Undersigned, for him/herself, his/her heirs, executors, administrators or assigns agrees that in the event any claim for personal injury, property damage or wrongful death shall be prosecuted against (2) _____ he/she shall indemnify and save harmless the same (2) _____ from any and all claims or causes of action by whomever of wherever made or presented for personal injuries, property damage or wrongful death.

The Undersigned acknowledges that he/she has read the foregoing two paragraphs, has been fully and completely advised of the potential dangers incidental to engaging in the activity and instructing of skin and/or scuba diving, and is fully aware of the legal consequences of signing the within instrument.

WITNESS: _____ _____
Signature of Student

DATED: _____ _____
Signature of Parent or Guardian where applicable
Date of Birth: _____
Age at Time of Course: _____
years months

Legend:
(1) Full name of student.
(2) Full name of course instructor.
(3) Name of institution or organization sponsoring the course.

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MEDICAL HISTORY AND EXAMINATION FORM FOR TRAINING IN SKIN AND SCUBA DIVING

To the applicant: Complete the medical history portion before examination by the doctor
To the physician: The bearer requests evaluation of his fitness for diving with scuba — (self-contained underwater breathing apparatus). Besides assessment of his history, he requires a good general examination to include the following medical considerations:

1. Diving involves heavy exertion so he should be free of cardiovascular or respiratory diseases including obstructive lung diseases.
2. All body air spaces, particularly the ears and sinuses must equalize pressure readily.
3. Impairment of consciousness underwater may likely result in death.
4. Lack of emotional stability seriously endangers not only the applicant, but also his companions. Evidence of neurotic or panicky behavior should be evaluated before approval.

MEDICAL HISTORY

Name: _____ Age: _____ Sex: _____
Height: _____ Weight: _____
(If any of the following questions require an explanation, use the space labelled "remarks," giving the number of the question.)

1. Have you had previous experience in diving? Yes ____ No ____ Have you done any flying? Yes ____ No ____ If so, did you often have trouble equalizing pressure in your ears or sinuses? Yes ____ No ____ Can you go to the bottom of a swimming pool without having discomfort in ears or sinuses? Yes ____ No ____
2. Do you participate regularly in active sports? Yes ____ No ____ If so, specify what sports. If not, indicate what exercise you normally obtain _____
3. Have you ever been rejected for service or employment for medical reasons? Yes ____ No ____ (If yes, discuss with the doctor.)
4. When was your last physical examination? Month _____ Year _____
5. When was your last chest X ray? Month _____ Year _____

Check the blank if you have, or ever have had, any of the following. If so, discuss with the doctor.

6. Frequent colds or sore throat _____
7. Hay fever or sinus trouble _____
8. Trouble breathing through nose _____
9. Painful or running ear, mastoid trouble, broken ear drum _____
10. Asthma or shortness of breath after moderate exercise _____
11. Chest pain or persistent cough _____
12. Spells of fast, irregular, or pounding heartbeat _____
13. Any kind of "heart trouble" _____
15. Frequent upset stomach, heartburn, or indigestion _____
16. Frequent diarrhea or blood in the stools _____
17. Belly or back ache lasting more than a day or two _____
18. Kidney or bladder disease blood sugar, or albumin in urine _____
19. Syphilis or gonorrhea _____
20. Broken bone, serious sprain or dislocated joint _____
21. Rheumatism, arthritis or joint trouble _____
22. Severe or frequent headaches _____
23. Head injury causing unconsciousness _____
24. Dizzy spells, fainting spells, or fits _____

25. Nervous breakdown or periods of marked depression _____
26. Dislike for closed-in spaces, large open places, or high places _____
27. Any neurological condition _____
28. Train, sea, or air sickness _____
29. Alcoholism, or any drug or narcotic habit _____
30. Jaundice or hepatitis _____
31. Tuberculosis _____
32. Diabetes _____
33. Rheumatic fever _____
34. Any serious accident, injury, or illness not mentioned above _____

MEDICAL REPORT

I have examined _____ and reached the following conclusion concerning his fitness for diving:

_____ Approval (I find no defects that I consider imcompatible with skin and scuba diving.)

_____ Disapproval (Examinee has defects that I believe constitute unacceptable hazards to his health and safety in skin and scuba diving.)

The following conditions should be made known to any physician who treats this person for a diving accident: (Allergies, etc.)

_____

M.D.

_____ _____ _____

(Signature) (Address) (Date)

Chapter 11

SURFBOARDING

Henry F. Pohl
Loveladies, New Jersey

Surfboarding ranks third among popular individual aquatic sports, surpassed only by swimming and underwater diving. Over two million Americans participate in the sport. Of these, 85 percent are males under 21 years of age. Surfing seems to have mystical powers on the youths who live, sleep, and breathe it. With the development of the neoprene rubber suit, surfers are able to enjoy surfing year-round. Water of 45 degrees or lower does not deter the young surfers, for surfing contests are frequently held during the winter months.

Wherever there is access to waves and beaches, surfing schools have cropped up. These provide the best means for a beginner to get started in surfing. Although many outstanding surfers are self-taught, the process is long and arduous. With modern techniques, learning time can be greatly reduced. An expert surfing instructor can provide the essential knowledge in a few, short lessons. From that point on it is a matter of dedicated and patient practice. A beginner must get out into the water and spend several hours each day working on his technique under varying conditions. Every wave is a personal challenge; no two are alike.

Many beginners buy their boards first and then try to learn the sport. Instructors generally give their students an oversized board which provides stability and buoyancy, for this type of board is easiest to ride. Many youths, however, want to own the latest and most fashionable board. These boards are designed for the expert who has mastered the basic skills and can "ride-a-plank." Best practice for beginners is to follow the advice of a surfing school or surf shop as to which board is most suitable and to try a number of them before buying one.

One does not become an expert surfer in a year or two. It is a difficult process under all conditions. From the physical standpoint, the smaller, agile surfer makes the more picturesque and better surfer; the heavy six-footer needs powerful waves to push him through the water to gain all the advantages the lighter surfer will enjoy. This is why the little man is the one who gets most of the accolades in this sport. However, when it comes to big wave riding, larger men usually come out on top.

Accidents

There are relatively few fatalities from surfing accidents. Most surfing experts consider it a comparatively safe sport. However, statistics regarding accidents are limited. Most surfing injuries are minor in nature and do not preclude the surfer from participation while recovering. Disabling accidents are minimal because the surfer usually lands on a soft cushion, as compared to an automobile accident victim who is flung onto a hard surface.

The greatest speed that a surfer travels is 25 to 30 miles per hour. His chances of surviving a wipeout (a wave breaking on top of a surfer, causing him to be knocked off his board) or a pearl dive (the nose of the board knifing underwater) depends upon the amount of time the surfer spends on the board during the ride. Once a surfer overcomes the initial moments of the ride, he can generally minimize any disaster by maneuvering the board into such a position that he will

be free from collision with the plunging or flying board. Many surfers are aware of the pitfalls of being wiped out by a wall of water and have trained themselves to hold their breath underwater for 15 to 20 seconds or longer. Once turbulence passes, the surfer is popped upward and is free to fend for himself. This type of condition exists where huge masses of water break upon a shallow reef.

In the limited areas in which surfers are allowed to practice their sport, loose boards cause many minor accidents which result in injury to the head and torso. In the United States in 1977, fairly reliable statistics revealed that five persons lost their lives in surfing accidents. One well-known surfer lost his life by not practicing the safety rules of the Banzai pipeline, an area in Hawaii noted for dangerous waves. The rule requires that when a surfer misreads a wave and takes off incorrectly, he should dive back into the wave. This individual, who was an expert surfer conditioned to riding deep water, forgot this cardinal rule and dove head first into the shallow water receiving fatal injuries. Broken teeth and noses, cut eyebrows and chins, scalp gashes, and broken ribs are some of the occupational hazards of surfing. A properly trained surfer knows the technique of rising to the water surface after leaving the board in an emergency. Experienced surfers believe that surfing is a safe sport and any injury is caused by negligence, carelessness, and inexperience on the part of the surfer. Surfing is a calculated risk, many consider a small price to pay for the precious moments of exhilaration realized as he whips through a wild wave.

Unfortunately, some surfers regard it as a badge of honor to carry scars of the sport; wipeouts and injuries make tremendous conversation for those days and nights when one is with his closest friends and surfers.

Modern Surfboard

This ancient sport of the Polynesian Kings was reborn with the advent of World War II. Prior to that time, the West Coast was peppered with surf clubs. They had virtually all the beach front they could use for this sport. No limitations were placed upon the surfer or his club. During those times the surfer used a board which required great strength to handle and paddle. The boards were solid — made of redwood and balsa — and weighed 100 pounds or more. Modern surf riding developed in the United States and the techniques and skills used by the West Coasters have spread all over the world.

Early surfboards were standardized in length, width, weight and construction. In 1920, surfers began to experiment with various lengths and shapes of boards. Lightness made its appearance with the introduction of the balsa board and, immediately after that, Tom Blakes's hollow board. The most popular boards were solid, 12 to 14 feet long, and difficult to carry and maneuver in the water. The invention of fiberglass cloth and polyester resin in the 1940's enabled the surfer to experiment with rigidity and protection of the light, soft woods which were used in surfboard manufacturere. Immediately after World War II, a complete revolution of the sport took place with the appearance of foam boards. These boards were light, durable, sensitive to movements, and presented a new challenge to the surfer. The boards rapidly supplanted the balsa and hollow boards.

Mini Boards

As surfers began to improve their techniques and discover new adventures in wave riding, manufacturers sought new ideas to market their products in a highly competitive field. They engaged professional surfers to seek new avenues for the expression of their abilities. They began to change the shape, to shorten, and to lighten the boards by using higher density foams.

In 1968, the Mini Board, or the short board, with its various shapes and designs, was introduced. Its impact on the surfers was tremendous. Within a very short time, the Mini Board

proved that it was here to stay and has now, for the moment, replaced the heavy 10-foot foam board.

One must be an expert surfer to handle this short, unstable, lightning fast board. The modern surfer is no longer interested in riding the wave in the classic style of a Duke Kahanamoku. He looks upon a wave as a challenge. He wants to "wring-out-the-wave," "shoot-the-wave," "climb-the-wall," "go-over-the-falls," cut right, cut left, and perform maneuvers never before attempted. The Mini Board answers his desires for freedom and accomplishment of these feats. This modern board is usefuly only for the accomplished surfer. Its riding techniques are radical, the movements drastically different from those performed on the 10-footers. Only laborious and continuous practice result in the mastery of it. Professional surfers who represent manufacturers are constantly changing and improving the modern board. If the present trend continues, a four-foot disc made of foam will eventually be created, introducing a new venture into the ancient sport of the Polynesian Kings.

Safety Equipment

There is a group of surfing enthusiasts who believe that participants should wear protective equipment while surfing. One item that has made inroads into the sport is the crash helmet similar to the one worn by motorcyclists. Many contestants dislike the helmet because they find it cumbersome and a detriment once they are underwater. No contestant has yet claimed that the helmet has saved his life or prevented an injury. Because the majority of surfers who engage in contests are expert enough to handle any emergency, the usefulness of the helmet is highly controversial.

Another suggested safety item is the inflated or foam ski belt wrapped around the waist of the surfer. Not many have used it, but several surfing spokesmen feel this would be better than the helmet. Life jackets are a poor device because they need to be inflated before leaving the board. Thus, if the jacket were inflated and worn on the board, it would be difficult for the surfer to maneuver with it. Most expert surfers frown upon safety devices, probably because they surf in uncongested areas and know what they are doing. Under these circumstances they believe the possibilities of serious injury are minimal. The experts assume that surfers have a better chance of survival if they are unhindered by headgear, waist belt, or a carbon-dioxide jacket.

The use of a surf leash has become universal among Mini Board users. This six-foot piece of rubber cord, attached to the fin of the board and ankle of the surfer, saves him a long swim to recover his board after a wipeout. A point must be made regarding the use of the surf leash on the Mini Board. Since the Mini Board is 20 or less pounds in weight, the drag of a board out of control in the surf is minimal. The surfer can easily recover his board and survive any turbulence which the wipeout produces. This method of board control is not new. Tom Blake, back in the 30's, devised such a method for board control after a wipeout. It wasn't successful and was dropped quickly when it was discovered that a 100-pound board bouncing in a turbulent wave was no item to have attached to one's ankle. With the advent of the Mini Board, the idea was revived and it is a recommended piece of safety equipment today. Nevertheless, the fundamental skill required of a surfer is that he be an expert swimmer.

Surfing Areas

With the approach of spring and summer, signs at the beach fronts sprout up to warn surfers of the hours surfing is permitted. A surfer has two alternatives: to surf early in the morning before the beaches open for bathers and swimmers, or to surf after the beach closes in the early evening. Some municipalities have designated areas where surfers can surf all day. It is in these areas that congestion and accidents occur. Some areas are marked off by rock jetties, others by wooden bulkheads or by buoys in the water. If surfers could be allocated more space,

Figure 1. Cutting in front of another surfer about to take off can lead to collision and possible injury.

Figure 2. Courtesy prevents accidents. The bottom surfer is about to "pull out" and swing his board into the path of the other surfer.

Figure 3. Because of shallow water, riding the wave all the way to the beach is a dangerous stunt.

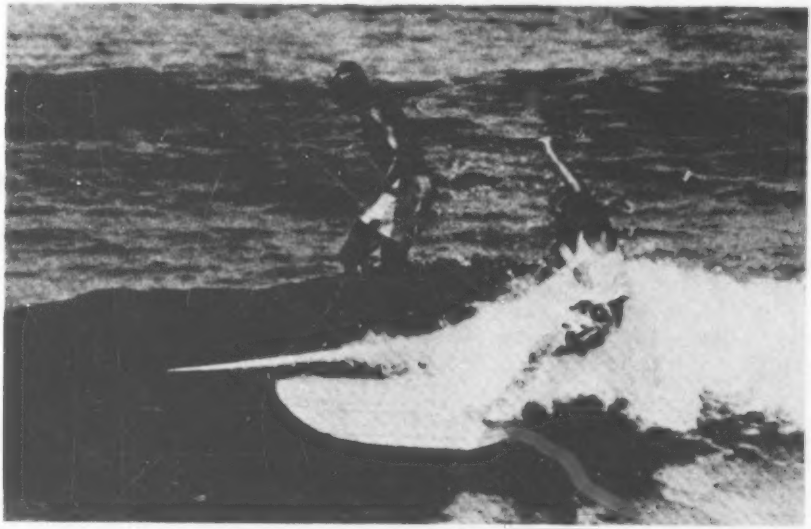

Figure 4. Collision between surfers is a common hazard at crowded beaches and where waves are small and close to shore.

congestion and its attendant accident potentials would be minimized.

Unfortunately, surfers often feel that they have the right of way and incidents have occurred when surfers have literally surfed over swimmers and bathers with their surfboards. Such discourtesy and lack of of consideration for others have created animosity and resulted in surfers being banned from many areas. Many surfers do not observe safe habits. Many ride their boards directly up to the beach. Some young surfers abandon their boards once they feel they are going to be spilled. The loose board is a hazard to bathers, and some beaches justifiably confiscate loose boards and require the surfer to pay a fine to recover his board.

Formal Surfboarding Instruction

In the opinion of this author, an instructional program in surfboarding should be divided into two phases — beginner and standard. The beginner course, comprising about five one-hour lessons, would be intended for individuals who have had no previous formal instruction.

The standard course, of about seven hours, would be designed for those who wish to perfect the beginning skills and offer advanced techniques. Each lesson would include an introductory lecture on the topic of the day (10 minutes), demonstration and practice of skills, both land and water (45 minutes), and a concluding question and discussion period (5 minutes). Variations can be made in time and content to meet different situations.

Surfboarding Today

Surfboarding has leveled off and the tremendous appeal the sport had during the past ten years has dissipated. No longer is this the number one sport of the teenager. He has turned to other sports which, at the moment, challenge and intrigue him. There is, however, a core of surfers who pursue the sport religiously. These are the former teenagers who were caught in the impact of the sport and now have "grown-old," so to speak. Lack of agility and more responsibility, have tempered this athlete to the degree that he no longer has the practice time or time to surf to regain his former status as a top rider of the waves. Then, the cost of the Mini Board and repairs have also placed a financial burden upon the working surfer. So to compensate for his lost physical skill, he has turned to a longer, wider, and heavier board so he doesn't need the agility of his former days. Therefore, the modern trend is to ride a seven-, eight-, or even a nine-foot board which is easier to handle and gives a stable ride.

Since the sport of surfboarding has become less popular, many manufacturers have gone out of business. However, there are board builders around surfing areas who will build a board to specification if so desired. So, with the boom over, more surfing area is available; the hassles with the police and township authorities are at a minimum and surfing is back to normal for those who seek the perfect wave and ride.

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